HOME REPAIRS

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London : Sidgwick & Jackson, Ltd.
3 Adam Street, Adelphi.

Printed in Great Britain, 1923

PREFACE

THE purpose of this book is to assist the householder to keep his home in habitable repair, by instructing him how to carry out with his own hands many small jobs which are well within the powers of an amateur.

Although there must remain, for most householders, certain technical jobs—*e.g.*, in the higher branches of electricity and the deeper roots of drainage—for which skilled labour must be sought, yet in these days, when many a householder is also perforce the house-owner, he can no longer afford to call in the plumber (and his mate) when a cistern overflows or the scullery tap is out of order. A small capital outlay on a few tools will be soon counter-balanced by the diminution or disappearance of bills for repairs, and the "new poor" householder (and *his* mate) will not only find additional satisfaction in personally keeping the home in good order, but will also be giving the younger generation object-lessons in domesticity, not to say in "economy," in both its original and its modern sense.

No process, method, material or proprietary article is recommended in this book except from practical experience. The author gratefully acknowledges the assistance in many details of Mr. R. Keith-Johnston. Every care has been taken to explain principles and to make the instructions as far as possible "fool-proof."

K. G.

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CHAPTER I

TOOLS

The Selection of Tools.

THE home repairer's first requisite is an outfit of suitable tools; and by suitable tools I mean tools of full size such as a workman would use, for it is generally impossible to do good work with toy or "amateur's" tools. The following list will be found sufficient for all usual occasions:

Hammer.—These are sold in many varieties, but of those selected for household work one should have a flattened "pane." The "pane" of a hammer is the back part of the head. Two kinds, known as Riveting Hammers and Warrington Hammers, possess this feature. The size is generally indicated by a figure, which is clearly stamped on the head. No. 5 or 6, weight about $1\frac{1}{4}$ pounds and $1\frac{1}{2}$ pounds respectively, of either kind will be found suitable. The flat edge of the hammer will be found useful for the first few taps when driving in small nails and brads.

A claw-hammer, weighing about $1\frac{1}{2}$ pounds, is also extremely useful, not only for driving in nails, but for extracting them, and the American Adze-Eye Hammer is by far the best of this kind, as its claw is properly tapered and hardened so that it will pull out a nail with a very small head, or none at all!

The face of the head must be kept clean and bright, and the shaft in good repair, especially the end which passes through the head. The user does not run much risk, but an interested spectator or any object in the "line of flight" is liable to suffer considerably if the head works off. The head is secured by a little wooden

or iron wedge, driven into the end of the shaft. A new wedge, which can easily be cut from a small piece of hard wood, should be fitted when signs of looseness appear; the wedge should be wetted before it is driven in.

Screw-Driver.—These are often called "turn screws." Suitable kinds are known as London Pattern Turn Screws, or London Pattern Cabinet Turn Screws. Two sizes are advisable, 3-inch and 8-inch. These will take screws of any size likely to be wanted in general repairs.

Bradawl.—One or two of these in different sizes are necessary to bore holes for screws. Without a hole it is almost impossible to start a screw or to drive it in straight, especially in hard wood. Having made the hole, insert the screw, give it a little tap with a hammer, and then the screw-driver can be used. In selecting a bradawl, be sure that the steel point is well secured in the handle; if it is not, it soon develops the annoying habit of coming out of the handle and remaining firmly fixed in the wood in which you are boring the hole.

Gimlet.—For larger screws, and for hard wood such as oak or beech, a gimlet is necessary for boring the hole. This tool cuts out a little of the wood, and so makes the turning of a screw easier. The use of a gimlet is especially necessary when brass screws are to be used, for the heads are easily twisted off if they fit too tight in the hole. With a stout screw in hard wood the operation requires considerable strength, especially the last few turns which drive the screw firmly home. A little grease on the screw makes it easier, and is still more necessary when it is likely that at some future time you will want to take the screw out.

Saw.—It is easier to saw wood across the grain than with it. A small Tenon Saw, also called a Back Saw, one which has fine teeth and is made of thin steel, is best for the first operation, but the thinness of the steel makes it liable to buckle, and so it is strengthened with a narrow iron or brass back along the top edge. This back gets in the way when the cut is deep, but a saw-cut across the grain is not usually very deep, and so this kind is very suitable for

cross cutting. A 10-inch or 12-inch saw is the most useful for the purpose. For fine work a Dovetail Saw, which is similar in shape but smaller in every way, is very useful.

In sawing wood with, or along, the grain, the cuts are often deep, and so for this work a tool is wanted without a stiffened back. Thus one is forced to select a different type, stronger because it is made of thicker steel and with coarser teeth to tear away the wood fibres. What is known as a Half-Rip Saw is the most suitable, and one of these about 24-inch size is recommended. The sharpening of saws requires skill and experience, and should be left to a practised hand; it is best to take them, as well as any tools that require grinding, to a regular tool-shop, where they will be properly done. The cost is very small, and is well worth while. In addition to being sharpened, the teeth are bent slightly outwards alternately, one one side and one the other, making a cut wider than the thickness of the saw blade, which would otherwise rub against the edges of the cut and make the work impossibly hard. A saw, if used with care, will very rarely require sharpening, but care must be taken not to attempt to cut through a nail or screw embedded in the wood, because this will quickly dull the teeth. A hard rasping sound, quite different from the ordinary sound produced by sawing wood, will give a warning which must not be overlooked.

A saw should never be pushed or forced, but allowed to cut almost with its own weight. If pushed, it is certain to go off the straight line, so it pays to have one's saws kept keen.

Wrench or Spanner.—A small adjustable wrench or shifting spanner is a very necessary tool. Everyone who has a bicycle usually has one in his repair outfit. The ordinary King Dick is a most useful tool, but is not large enough for all purposes, and one 8 inches or 9 inches long should be bought as well.

Carpenter's Chisel.—Ordinary chisels with cutting edges about $\frac{3}{4}$ inch or 1 inch wide and one $\frac{3}{8}$ inch wide are most useful. The handles should be of beech or box wood.

Pliers.—These are sold in great variety. The best types for general household use are known as Gas Pliers, which have a wire-cutting arrangement and two curved jaws, which are convenient for gripping a round pipe. A pair of 6-inch Flat Jaw Pliers will often be wanted. Starretts make a very useful tool which has one flat jaw and one round one, which will serve many purposes in the house. The jaws are put in separately and can be replaced if damaged.

Pincers.—A pair of carpenter's pincers, about 8 inches long, with a claw at the end of one of the shafts.

Files.—A few files of assorted kinds, including four flat files—one 4-inch and one 6-inch smooth, one 6-inch and one 8-inch second cut; four half-round files—one 6-inch and one 8-inch smooth, one 6-inch and one 8-inch second cut; two three-square files, triangular in section—one 6-inch smooth, one 8-inch second cut. One or two file handles are very cheap, and very necessary, for it is dangerous to use a file without.

A **Nail Punch** of medium size is sure to be wanted.

Wooden Mallet.—This is necessary when one has to hit any tool having a handle of wood, which would soon be split if hit with a metal hammer.

The list given above should be regarded as the minimum outfit for household work, and there is no doubt that all the usual repairs can be undertaken with it; but many more jobs can be tackled if we add a 6-inch cold chisel for cutting metal, a pair of tin-snips, and a hack-saw; and I would strongly advise, too, a small vice to fix to the kitchen table by a clamp underneath, if a permanent bench cannot be secured.

There are occasions when a special piece of work may require a special tool, and if in writing the following pages such a "job" is dealt with, the tool for the work will be described. For a start, then, we will be content with what we have provided. As we proceed it is more than probable that the pleasure, and the advantage from the financial

aspect, may encourage us to add to our list, and we may even be tempted to equip a regular private workshop.

The Use and Care of Tools.

Most people who have not been told how to use tools fail to do good work because they hold them in the wrong manner or do not keep them in good order.

Saw.—In using a saw, for instance, nine amateurs out of ten will hold it as if clenching a fist round the handle.

Fig. 1.—Holding a Saw.

In this way there is no control whatever over the direction of the cut. A saw should be held with the forefinger resting along the side of the handle, so that the blade can be guided straight. This applies whether the saw be used with the right hand or the left hand. The use of the latter will often be found convenient in confined spaces where it is awkward to work with the right; it is especially useful in

lopping a tree when one can hold on to the trunk with the right hand and saw the branches on one's left with the left hand, and after a little practice it will be found almost as easy as with the right.

In using tools, it always pays to take a little trouble. No saw-cut should be begun without first marking a line with a pencil, or even a scratch with a brad-awl or a nail, exactly where the cut is to be made. See that you get a fair start exactly on the end of the line; stand with an eye on each side of the blade, so that you do not see the blade itself, but only the line along which you are to cut, and keep in that position all the time. Your cut will then be both straight and square with the surface of the wood. Remember, too, that it is much easier to saw exactly *on* a line than just *beside* it. If you get a false start a little off the mark, your cut will certainly not be straight; and if you start off the line you cannot drag the saw into the right path, so make a fresh start and get right on the line.

Let the saw do the cutting almost with its own weight—that is to say, do not press the saw, for if it seems to need forcing either it is blunt and must be sharpened or you are trying to cut away from the line. When you have a cut to make along the grain, see that you start with the grain. Your rip-saw will cut against the grain, but is very likely to be led off its right course by the grain of the wood.

Hammer.—Nearly everyone who uses a hammer holds it halfway down the handle, if not still nearer the head. In this way you get, not a stroke, but a sort of push; you get no benefit from the length of the handle, and might as well be using a flat-iron, which is heavy and hard, but is not a hammer. Hold the handle at the end, and let the weight of the head and the leverage of the handle do most of the work. In hammering in a nail, keep your eye on its head, not on the hammer—the natural sympathy between eye and hand will guide the hammer straight.

In using a cold chisel and hammer, or a wood chisel and mallet, look steadily at the edge of the tool, not at its head; your arm will instinctively guide your hammer true.

Do not hit a wooden tool-handle with a hammer, but with a wooden mallet; if you are compelled to use a hammer, use the flat side of it, and not the face of the head, otherwise you will spoil your tool-handle and blister your hands when you want to use the chisel in your hand.

Pincers and Pliers.—Do not forget to keep your grip on these; a relaxed grip lets the tool slip, and often spoils work and pinches fingers!

Screw-Driver.—It is very important to keep the end of this tool in good order. It must be square and at right angles to the length of the blade. A screw-driver that is rounded at the end is a hopeless thing to work with. It should never be used as a lever or to open boxes with, for such misuse ruins it for driving screws.

Wood Chisels.—It is no use to try to work with a blunt chisel, and frequent use of the oilstone is essential. Oilstones are of many sorts. Washita, Turkey, and carborundum are all good, but the last must be very fine in grain for keen-edged tools. Olive oil is generally used as a lubricant, but paraffin suits some stones best. In sharpening a chisel or a plane iron (which is merely a chisel set in a frame to guide it more truly than is possible by hand), take care to keep the angle the same as it was at first. Hold the tool lightly but firmly, with the right hand over the end of the iron and the left fingers near the cutting edge, and push it along the stone, pressing rather heavily on the forward stroke, but not at all on the back stroke. Take care to keep your right elbow at the same level all the time, for if you allow it to rock you will get a rounded edge to your tool instead of an angle. Keep your oilstone covered carefully so that no grit or dirt gets into it, as that would lead to a bad edge to your tools.

Files.—Hold the handle of the file in the right hand, and bear with the left (palm or fingers as convenient) on the end of the file.

Nail Punch.—This tool is often apt to slip if not hit square on the head when held merely between thumb and

fingers; it is better to hold it with the fingers placed alternately behind and in front of the punch, as in this way a more secure hold is obtained.

The final injunction to all beginners is to look after your tools with the same care you would give to your watch.

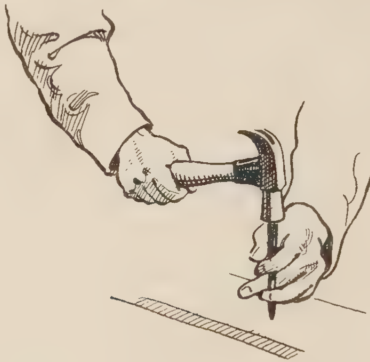

Fig. 2.—Holding a Punch.

Keep them clean and bright, the cutting edges keen, and the ends of the screw-drivers square, and do not forget the virtue of a little oil or grease to check the inroads of that ravaging destroyer, rust.

CHAPTER II

WATER-SUPPLY

Those who dwell in or near to towns enjoy a great privilege which is seldom appreciated as it deserves. Water is delivered to their homes, filtered and of good quality. Such water may be used with safety for all purposes without further treatment. The Company or Municipality must obtain Parliamentary powers before it can exercise the right to supply water to any locality; but Parliament, in granting the power, imposes certain obligations, and in fulfilling these obligations the good quality of the water is secured. The source of the supply must be approved, also the size and position of filter-beds and reservoirs, and, what is more important, the supplying Company is bound to maintain the quality of the water at a definite standard of purity, and it may be accepted as a general rule that water supplied by any such Company is suitable for drinking purposes.

Broadly speaking, the water used for domestic purposes is derived from rain. Rain-water in its first condition has one marked characteristic. This is its softness. When water is soft, it possesses a remarkable solvent quality. It can dissolve almost anything. In chemical laboratories, where perfectly pure soft water is frequently required, it even dissolves the glass vessels in which it is used. The process is gradual, but the effect is certain. Thus, in a mountain lake, where most of the water is the rain which has fallen in the hills and which flows over the surface of the ground into the hollow where the lake is situated, the water will be soft. Such sources are frequently used for the water-supply of towns. Loch Katrine supplies the water for Glasgow, and Thirlmere supplies Manchester.

Soft water has many advantages for domestic uses.

It is pleasant for personal use, and it delights the laundress. It requires very little soap, but from a dietetic point of view it is not so good as moderately hard water, and as it dissolves almost anything, lead must *not* be used for the service pipes, because dissolved lead in the water causes lead poisoning in the individual. It is also thought to be injurious to teeth, and not very wholesome for children. But taking all these points into consideration, it is deemed a suitable water for the domestic supply.

Water is also frequently taken from the upper reaches of rivers, *above* the sites of large towns where effluents from sewage systems and factories pollute the stream. Before reaching the river, some of the water has often travelled great distances from the position where it fell as rain, and on its way has dissolved the chalk and other earthy substances with which it has come in contact, and which it carries in solution. This water is harder than that obtained from the mountain lake, and has lost some of the bad and some of the good qualities of the latter.

There is one other source of supply. Where no suitable river or lake is available, wells are sunk deep down into the chalk which is found in most parts of the British Isles. In this case the water is found to be very hard, and in most instances the Companies are required to reduce the hardness by treating the water chemically before delivering it for domestic use.

Hardness is measured by degrees. Water said to have 10 degrees of hardness will be found to contain 10 grains of chalky material in every gallon evaporated.

A large portion of the water supplied to London is derived from deep wells, and all the Companies were required by Parliament to reduce this hardness to 15 degrees. Water with from 10 to 15 degrees of hardness is probably the best for general purposes.

The water flows into the house through what is called "the rising main." This main is controlled by a stop-cock, which is fitted by the Company at the expense of the householder, and it and the supply pipe must be maintained in good order by him. The Company owns and maintains

only the large iron main which feeds all the house supply pipes. The stop-cock is in nearly every case placed outside the house. To protect it from frost, it is sunk below the ground. To operate it, a long iron key is necessary. Every householder should make it his business to find out where this stop-cock is, and to provide himself with a key, so that he can shut off the water if necessary.

Inside the house the rising main is taken up to the cold-water storage cistern. In many instances a second stop-cock is provided on this main, inside the house and easily accessible. This is a great convenience, and where one does not exist, the householder is recommended to have one fixed. If it is necessary to cut off the water-supply in any emergency the inside stop-cock is an obvious advantage.

The rising main terminates in a "ball-valve" which discharges into the cold-water cistern. This cistern is intended to form a reserve of water inside the house, in case at any time the Water Company cuts off the supply. Fifty or sixty gallons of water will be found sufficient in any average house to carry over any time during which the supply is cut off, and a cistern of this capacity is usually found sufficient.*

Cleaning a Cistern.

But it is necessary to keep the cistern clean.

The tank or cistern should have a wooden cover. Where this is not provided, the handy man will do well to make one for himself. With a well-fitting lid to keep out the dust, the tank keeps much cleaner than when uncovered, especially if placed, as commonly, in a loft under an ordinary tiled roof.

* A cubic foot of water equals $6\frac{1}{4}$ gallons. An ordinary household cistern, therefore, which measured 3 feet 6 inches by 2 feet, and contained water to the depth of 1 foot 3 inches, would be holding $3\frac{1}{2} \times 2 \times 1\frac{1}{4}$ or $8\frac{3}{4}$ cubic feet, or very nearly $54\frac{3}{4}$ gallons.

When considering the advisability of increasing the size of one's cistern, it is well to remember that a gallon of water weighs 10 lbs. The weight of the water in the above cistern (apart from the weight of the cistern itself) would be about 547 lbs.—nearly a quarter of a ton.

The tank should be thoroughly cleaned out every year, or at least every two years; the job will take anything up to three hours, and to the energetic householder the before-breakfast hours of a Sunday morning in early summer may be suggested as a suitable opportunity.

The utensils required are a pail (or two), two or three large clean house cloths, and some assorted sizes of rubber corks, if available; if not, wooden plugs made from an old broom-handle cut to a taper and with a bit of rag tied round are equally effective; a mop or an old sponge and a pair of gum-boots are desirable, but bare legs and old gym. shoes do as well.

To start, shut off the stop-cock on the rising main. If there is no stop-cock, lift the ball-cock and tie it up to stop the inflow. Be careful not to touch the ball on the end of the lever, or to push against it while the cistern is being cleaned out. The ball sometimes comes off very easily. Turn on all the cold-water taps in the house, to empty the tank; an inch or so of the water will be left at the bottom, as the service pipe rises a little above the floor of the tank.

With any but the smallest-sized tank, the operator will then do well to don his gum-boots and get in bodily. He will at once push a rubber cork or plug into the mouth of the outlet or "down service" pipe (or pipes, if more than one); then with mop or cloth wash down the sides of the tank and scrub the bottom. The colour of the water by this time will probably surprise him. He will then bail, mop, or sponge up the dirty water into a pail, and when this is completely done, let in a little clean water from the ball-valve, swab round again, mop up, and repeat the process with more clean water until satisfied that the tank is thoroughly clean. If at the start the tank is very foul, it is a good thing to use some Condy's Fluid or other disinfectant, such as Jeyes', and a scrubbing brush for the first wash; or the "Condy" may be left for the finish.

When all is clean and wiped over, the operator *must not forget to remove the plugs from the service pipes* before climbing out; then release the ball-cock and put on the lid.

It is a good plan to cover the lid with some sheets of old newspaper or brown paper, with a couple of sacks over all, to exclude dust all the year round and frost in the winter.

Service Pipes.

From the cold-water cistern pipes are brought down to the different taps, lavatories, if there are any, and water-closets. But there should be one exception to this rule. The paragraph relative to the cleaning of cisterns shows how dirty they sometimes become. Therefore it is important that *no water for drinking purposes should be drawn from a tank*. To avoid this, all that is necessary is to have a branch taken *off the rising main*, terminating in a bib-cock, or tap, on purpose for drinking-water. A half-inch tap is quite large enough for the purpose. It must be fixed in such a position that the drip from it will run away to the drains. Thus, any position over a lavatory basin, a sink, or even a bath, will be quite suitable. Failing any of these, a special drip sink should be provided.

Repairing Taps.

Every tap or bib-cock will at times need attention.

Under the handle of the tap you will find a square or hexagon nut through which the spindle works. This nut is often, though by no means always, prevented from turning by a screw driven through its side or flange, and this screw must be taken out before the nut itself can be unscrewed. To unscrew the nut you will require your large shifting spanner, as these nuts often stick rather tight.

Of course, you must first turn off the water. In good work there is a stop-cock on the pipe leading down from the tank; but too commonly there is no such convenience, and you must either shut off the stop-cock on the rising main, or tie up the ball-valve in the cistern and run the water off, or make a long plug to stop up the end of the pipe *inside* the tank, so that the water cannot get down

to the tap you are repairing. This plan will save much time if the tank is large and takes long to empty; it has the additional advantage of leaving all the other pipes in operation. You then open the tap you are going to repair to its *fullest extent,* and unscrew the nut round the spindle. In unscrewing this nut, you will have to be sure that you are trying to turn it in the correct direction, because the screws in these nuts are sometimes right-hand and some-

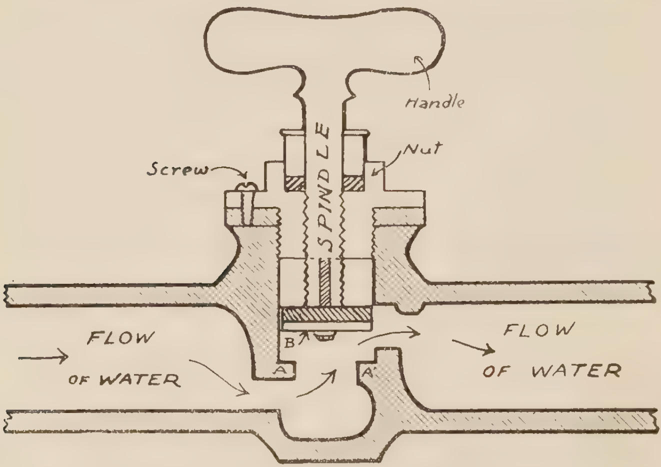

FIG. 3.—SECTION OF SCREW-DOWN TAP.
A-A', Valve-seating; B, jumper-washer.

times left-hand. If you find the nut will not turn in the counter-clockwise direction, try to move it the opposite way. A judicious tap with a hammer, on the handle of your shifting spanner, will generally reveal the direction in which force should be applied. When the nut is fully unscrewed, the spindle, handle, and nut will come away, and what is called the "jumper" will usually remain on the valve seating inside the tap, though sometimes it is made to come out with the spindle. You must fish this out, and will find it something like Fig. 4.

The old washer will be found partly worn away or squeezed out of shape between the little nut at the end of the jumper and the round metal disc. Unscrew the nut, thoroughly clear away every scrap of the old washer, and put on the new one (generally $\frac{1}{2}$ inch for taps of lavatories, $\frac{3}{4}$ inch for sinks, and $\frac{3}{4}$ inch or 1 inch for baths; sometimes $\frac{5}{8}$-inch washers are used) and screw the small nut on again. Then replace the spindle, etc., making sure that the tap-handle is kept open all the time, and screw the large nut fairly tight. Turn on the water-supply, and when the gurgling and spluttering have ceased, screw down the tap and see the result. If no drip comes, your job is well and truly done. Different washers are usually supplied for hot and for cold water, so you must say which you require when you buy the washers.

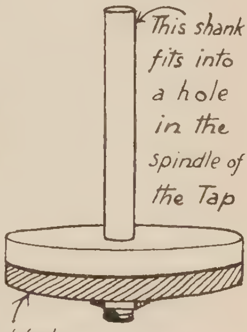

FIG. 4.—JUMPER AND WASHER.

If you are repairing the washer of the drinking-water tap, the one which should be connected directly to the rising main, the stop-cock on this main must be shut off.

If you are repairing a hot-water tap, and there is no stop-cock on the branch leading to it, it is necessary to shut off the stop-cock on the cold-water feed pipe to the hot-water system. In this case it is advisable to make the repair when the fire in the kitchen range is not alight.

Sometimes you will find that the jumper has been broken. If you take the old one to an ironmonger, he will most likely be able to let you have a new one.

The washers are comparatively soft, far softer than the metal of which the tap is made, and as the action of screwing down the spindle forces the soft washer against the hard edges inside the tap, the washer must suffer if too much force is applied. For this reason it is highly desirable to warn children (or grown-ups, if of careless disposition) *not to screw any tap down too hard.* To force a screw tap

down tight is "very hard on" the washer, and is a sure way to shorten its life. Taps should be turned off quite gently with finger and thumb only, and the screwing-down action should stop the instant that the flow ceases. This is most important when the washer is newly put on; a hard squeeze then, while the washer is comparatively soft, may spoil it right away.

Ball-Valve Repairs.

The supply to water-closets usually comes from the cold-water cistern. In some cases it is brought directly off the main. In what is known as the plug closet the water is laid on right to the closet pan, and the pulling up of the plug operates a valve, which automatically shuts itself after a short interval. In the modern water-closet a different method has been adopted. Each closet is provided with a small cistern holding about 2 gallons, and called a Waste Preventer or flushing cistern. In this cistern is a ball-valve. This is a bib-cock in which, instead of having an ordinary handle to screw up or down for opening or closing the valve, there is an arm or lever on the end of which is fixed a hollow copper ball which acts as a float, raising the arm as the water comes in, and so closing the valve. When the water is let out of the cistern by "pulling the plug," the ball sinks down, opening the valve and letting in the new supply of water to fill the cistern again. As in the ordinary bib-cock, the actual shutting off of the water depends on a washer. When the washer is pressed against a metal seating, it stops the water from passing through the valve into the cistern.

There are slight variations in design of ball-valves, but all have the arm with the ball or float (sometimes it is only half a "ball") attached. To renew the washer, the arm must be removed, and when it comes away, the small metal plunger which contains the washer will come away with it.

The first operation is to shut off the water from the ball-valve. If there is a stop-cock between the cold-water cistern and the Waste Preventer, this is quite a simple matter. When there is no stop-cock, it is necessary to shut

off the supply to the storage cistern and, as in the case of cleaning this cistern, let all the water in it run away, or plug the end of the supply pipe inside the cistern.

When the arm is in position, the end away from the copper ball swings loosely in a slot forming part of the valve in the Waste Preventer. There are holes through the sides of the slot, and a corresponding hole in the end of the lever. A brass split pin (because brass does not rust) is pushed through these three holes, when it forms what is really a small hinge or axle, on which the arm can rock. The reason for using a split pin, instead of a solid pin, is that it is made with a certain amount of spring in it, which tends to keep the ends apart, and so prevents it from

FIG. 5.—BALL-COCK.

working out. To remove it you require your pliers. If the ends of the split pin have been bent back, you can straighten them first with a screw-driver and finally with the flat-jawed pliers. Take firm hold of the eyelet end and draw out the pin. This is sometimes rather hard to do, but by twisting it first one way and then the other, and hauling all the time, it will come safely away. As soon as it is out, the arm can be removed. The extreme end of the arm is threaded through a slot in the metal plug in which the washer is fixed.

This plug will easily slip off the arm—in fact, it generally falls off into the cistern if you are not careful; on examining it closely you will see a thin line round it near the end. This line is the end of a small screwed thimble, or cap,

which holds the washer. You can take hold of it firmly with the rounded jaws of the gas pliers, turning it counter-clockwise, when you are looking down on the washer. Counter-clockwise, of course, means in the direction opposite to that of the movement of the hands of a clock. When the cap comes off, remove very carefully every particle of the old washer and put the new one in position, and screw the thimble back again into its place. What is called rubber insertion, consisting of two thin layers of rubber (red rubber is best) with a layer of canvas between them, is the best material for the washer, which must be carefully cut so that it fits exactly into the thimble, which has a small flange at the end to keep the washer in its place. Rubber insertion is made of various thicknesses, known technically as 1-ply, 2-ply, and 3-ply. What we want for our small job is a small piece of 1-ply, about $\frac{1}{2}$ inch square. The ironmonger, and failing him, the plumber, will probably let you have a little piece; but if you are driven to ask the latter, it may be well not to explain the purpose for which it is required, for if he happens to be unsympathetic, he may hand you a worthless piece of rubber. Having fixed your washer, the holder must be threaded on the arm, which is then ready to be replaced. The operation is a rather tiresome one, because the Waste Preventer is almost always too close to the ceiling to give room to work inside it, and at best the space in which you have to get two hands and your tools is very small. A little practice, however, soon makes one proficient.

While dealing with ball-valves, whether on main tanks or on Waste Preventers, there is one important matter that must be mentioned. A valve of this type automatically controls the supply of water to the cistern. If anything goes wrong with the valve, it may fail to stop the inflow of water, and an overflow will result. To avoid damage from this cause, an outlet for the overflow is provided for every cold-water cistern. This pipe, under a regulation of all Water Companies, must be taken to a point where the drip from it can be easily seen. This drip will then inform the householder when a ball-valve needs

his attention; but it sometimes happens that water drips from the overflow pipe when the washer has just been renewed, and then one is forced to look for another cause of the nuisance. It may be one of two things. It may be a leak at the point where the pipe is attached to the valve, or even in the valve itself, but more frequently it will be because the arm of the ball-valve has become bent and so does not shut off the water soon enough, and allows it to rise in the cistern above the level of the overflow pipe. This condition is gradually brought about by the upward pressure of the water on the floating ball. This continual pressure will in time bend the arm upwards, until at last the shutting-off point of the valve is not reached until

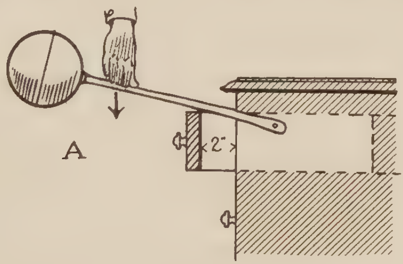

Fig. 6.—Bending Arm of Ball-Valve.

the water in the cistern is above the overflow. The remedy is to bend the arm down again.

Do not try to bend the arm while it is in the cistern. It is better to remove it, as when renewing the washer, and do the thing in comfort and with certainty. For there is one very important point that must be observed. In bending the arm, see that none of the power required is applied to the ball itself, for it is often only fastened to the arm with solder, and is easily broken off; and if this happens, you may have to call in the plumber after all. A convenient way to bend the arm is to use an open drawer of a desk or table (there is generally such a drawer in a kitchen-table). If the drawer is pulled out about 2 inches,

the end of the arm farthest from the ball can be put *under* the framework of the table, and the part of the arm about 2 inches away will then pass *over* the front of the drawer itself, and then a little steady pressure downwards, near the ball, but not touching the ball, will bend the arm. You need not bend the arm much. If you place the arm on its side on a piece of paper on a table, so that the ball just projects over the side, you can draw with a pencil the outline of the arm. Do this before you start, and then bend the arm about $\frac{1}{2}$ inch, and try the effect. If the water still overflows, bend the arm another $\frac{1}{2}$ inch and try again until it is right. If you bend it too much it will shut off the water before the tank is full enough. The bending must be done very gradually, as it is extremely easy to break the arm in two ! A wise precaution is to mark the upper edge of the arm with a light file mark, so that you may be sure which way you want to bend it.

Sometimes the arm is screwed into a little socket which is soldered to the ball. If yours is made in this way, unscrew the ball. Do not take hold of the ball in doing this. Grasp the *socket* with your gas pliers, and twist the arm counter-clockwise. The arm is flattened except at the end where it enters the socket, so your big spanner will enable you to get a good hold on the arm while you grip the socket with the gas pliers. You must always remember that the solder which attaches the socket to the copper ball will not stand any force. It may snap off most unexpectedly, and that is the one thing particular care must be taken to avoid.

Sometimes the ball-valve in the flushing cistern of a water-closet requires to be bent upwards. So many of these cisterns have a most irritating habit of not discharging when you pull the lever. This is because the jerking action of the operation tends to bend the arm too much in a downward direction, and then the valve shuts off the water too early. There is generally a mark inside the flushing cistern showing the level at which the water should stand when the cistern is charged. When there is no such mark to guide you, the arm should be

bent so that the water shuts off about 1 inch below the overflow. This is often rather a tiresome operation, and it may be necessary to have one or two trials before you are successful. If the valve shuts off too soon, the water will not discharge properly; and if too late, it continually drips from the overflow, so a position between these two levels must be found. In the ordinary storage tank it is a simpler matter, because all you have to guard against is an overflow if the valve does not shut off soon enough.

Briefly, the rule is, bend the arm *upwards* if the valve shuts off too soon, and *downwards* if it shuts off too late.

It sometimes happens that the failure to shut off the water is due to a small hole having developed in the copper ball, which has allowed water to leak into it. If, on removing the lever, you find there is water inside the ball, examine it carefully and locate the faulty place. Having found it, enlarge the hole slightly with the pointed end of the shank of a file, until the hole is large enough to allow the water to drain out. A small piece of blotting-paper, twisted into the form of a "spill," inserted into the hole, will facilitate the draining out of the water. The ball should be held so that the hole is exactly at the bottom. When the water has been removed, the hole in the ball can be repaired with solder (see "Soldering," p. 131).

Hot-Water Service.

In nearly every house there is a hot-water service heated by a boiler in the kitchen range, or, in some cases, by an independent boiler (see below, p. 27). The boiler is connected by "flow" and "return" pipes to a tank. The tank is fixed either at the top of the house, just below the cold-water cistern, or in the bathroom, or in the kitchen or scullery, in which case it is usually cylindrical in form. In the two former cases the arrangement is known as the Tank system, and the latter the Cylinder system.

In both systems a good supply of hot water can be obtained if the arrangement of the pipes is good.

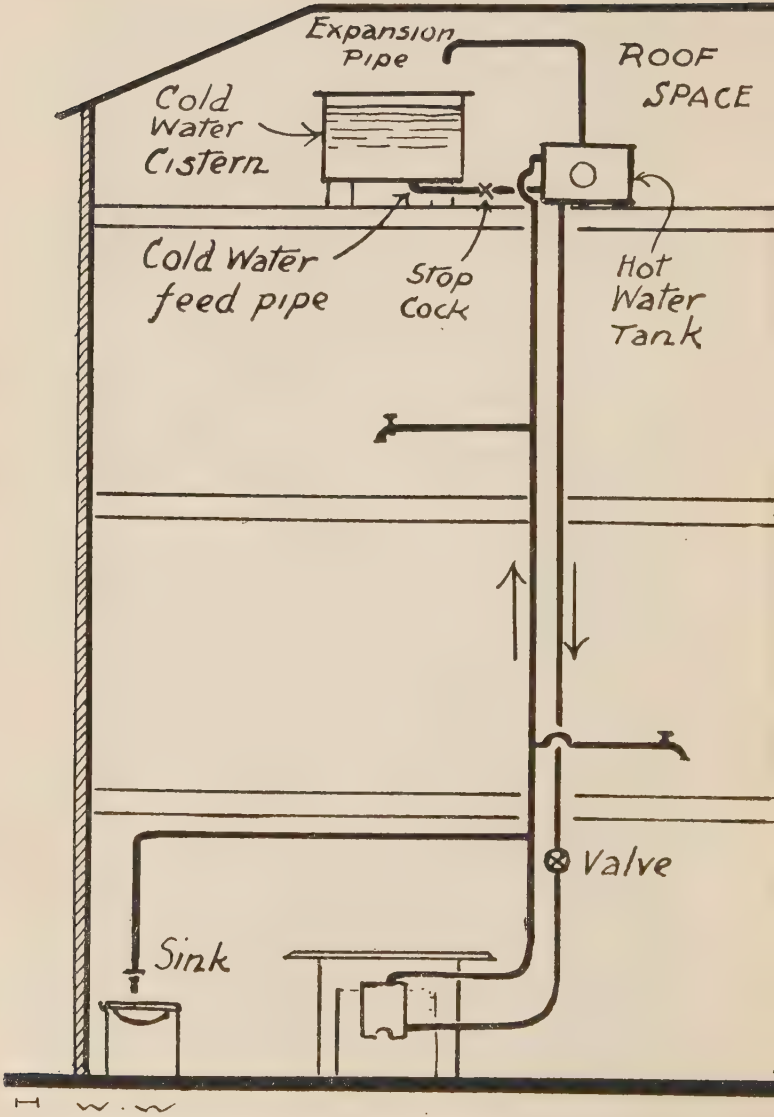

FIG. 7.—TANK SYSTEM.

Hardness and softness of water have been referred to. These qualities are of special interest in connection with the

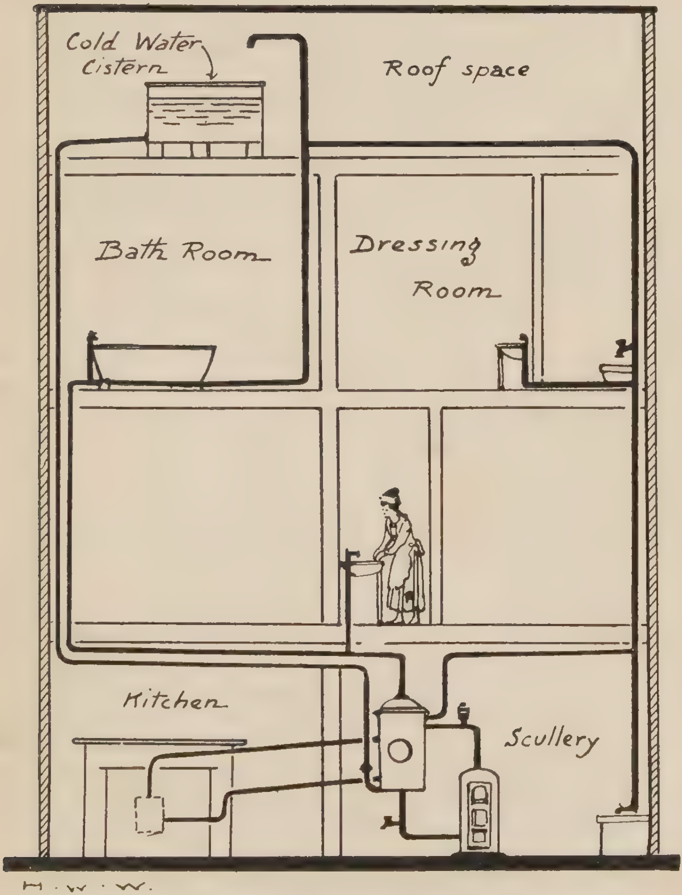

FIG. 8.—CYLINDER SYSTEM.

hot-water service, because it is in the process of heating the water that their effect is chiefly noticed.

Cleaning Boilers.

When the water is hard, the inside of the boiler and pipes gradually becomes coated with a hard deposit, which must from time to time be cleaned out. The harder the water,

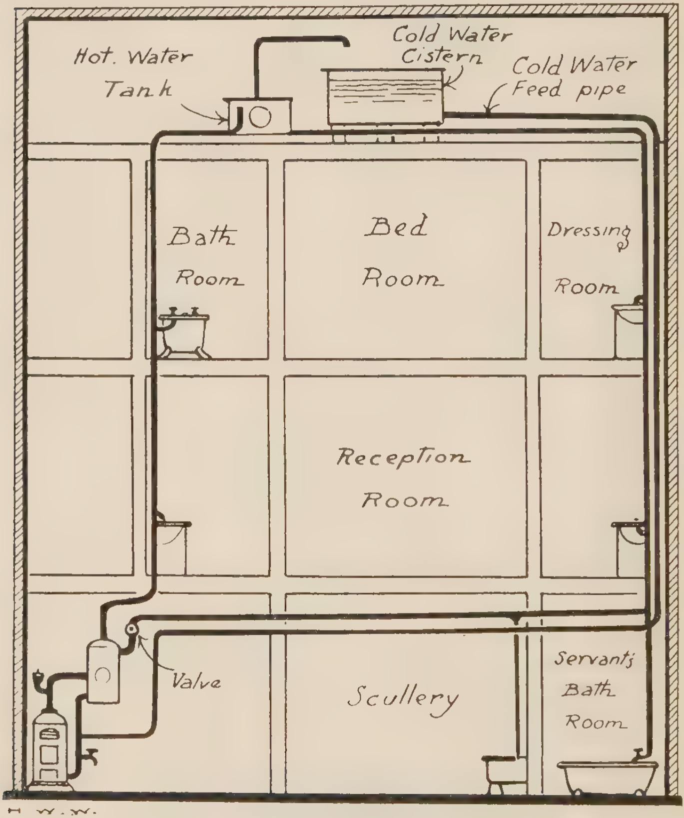

FIG. 9.—TANK AND CYLINDER SYSTEM.

the more frequently must this matter be attended to. In some districts, where the water is very hard, it is

advisable to do this three times a year. This is unusual. In London once a year is sufficient.

This work can hardly be undertaken by the householder. It requires not only heavy and expensive tools, but also great strength to loosen the nuts securing the manhole on the boiler and the sockets on the pipes, and these are not easily accessible. The boiler is fitted in the cooking range, and some of the pipes are buried in the brick setting surrounding the range. It is therefore necessary to call in the practised workman. His advice should also be sought as to the frequency of the cleaning-out operation.

If the matter is neglected, the supply of hot water gradually decreases. At a later stage the system begins to make pulsating noises of increasing intensity during the process of heating the water in the boiler.

This last symptom should never be ignored. It indicates that a dangerous condition is arising, in which the final result is an explosion. The apparatus may and should be fitted with a safety valve, but in cases where the water is hard, the valve gradually becomes coated with deposit, which effectively seals it. In this state it is worse than useless: it is dangerous, for the valve, which is intended to give warning when the pressure in the boiler rises towards the danger point, being blocked, is unable to do so.

Everyone knows the seriousness of a boiler explosion, and how in many instances it has resulted in the death of those who were unfortunate enough to be near.

As soon as the noises referred to occur, arrange for the cleaning out of the hot-water system. It is wiser not to light a fire in the kitchen range until it is done. If for any reason the fire is lighted by anyone not acquainted with the conditions, and the noises in the pipes begin, the first step to take is to turn on all the hot-water taps, then close the damper of the boiler flue, and then draw out the fire.

Sometimes a hard frost at night may effectively block up the main pipes and the cold-water feed, and so completely seal the apparatus. This may happen when the boiler and pipes have been cleaned out, and are known to

be free from hard deposit. In this case a dangerous condition has arisen, and the only warning is the throbbing noise which starts. *Accept the warning at once, and act as indicated above.*

When the water-supply is soft, there is no risk of deposit occurring, because the soft water has nothing in solution which can be deposited when its temperature is raised. On the other hand, it comes " all armed " with the power to dissolve almost anything with which it comes in contact. In many districts iron boiler pipes and tanks are quite useless, because they are so quickly eaten away by the water, and all the hot water is stained with rust. In such cases copper is used, and the result is quite satisfactory. There is, of course, no " furring " of the pipes, and so no risk of explosion from this cause, but soft water is just as liable to frost as hard, so the second cause remains.

The final conclusion, then, is to protect every part of the system by covering it with good non-conducting material where it is exposed to the outside temperature changes. In many houses the cold-water storage cistern and the hot tank are in the roof space. They should be carefully wrapped in thick felt, which can be bought for the purpose. All pipes leading from and to them should also be carefully covered. Also, any pipes exposed in passages or unoccupied rooms in a house should either be cased in or wrapped in felt. Not only does this protect them from frost, but in the case of the hot-water pipes conserves valuable heat. For this latter reason alone the covering of the pipes is recommended. A reference to the diagrams of the hot-water systems will show that pipes are provided, called the " flow " main and the " return " main, through which the water continually circulates when it is being heated up, or when it is cooling. When the water is passing through the pipes, it gives out its heat much more readily than when it is in the tank or cylinder. Any heat loss that can be prevented from the pipes, therefore, is all to the good, and in this connection a valve in the return main which can be closed at night when the fire in the kitchen range dies down will stop the circulation of the water. This valve must be

opened again when the fire is relighted, but by stopping the circulation during the night the mass of water in the tank will still be warm in the morning, and the difficulty of the early morning warm bath is greatly reduced. The valve should be fixed in the return main, and in a conveniently accessible position, so that it is easy to get to it. The addition of this valve and the covering of the pipes and tank will make a very considerable improvement in an unsatisfactory hot-water service.

Independent Boilers.

A small independent boiler can be fixed near the range and connected to the existing pipes and cisterns. It may be heated either with coke or with gas, but coke is the cheaper fuel; it will also work well when fed with all sorts of kitchen refuse, and is a profitable way of getting rid of much burnable matter which generally goes into the dust-bin. A separate boiler of this description soon proves a valuable acquisition in a household where there is a large demand for hot water. It does not interfere in any way with the regular range, and only comes into use when a fire in the kitchener is not wanted—for instance, during the summer, or where cooking is done by a gas cooker. Its installation is, of course, beyond the powers of the handy man, and must be entrusted to professional hands.

Geysers.

If it is decided to have the water heated by gas, it is advisable to instal an apparatus which consumes gas only when hot water is actually wanted. There is such a type, usually fixed over the bath, known as the Geyser. This must be used with care, the directions being carefully followed. It must always be provided with a flue, and the flue should be constructed so that a down current of air cannot enter the flue pipe. These precautions being taken, the Geyser has proved an economical means of securing hot water. A fitting in which the gas is kept continually burning is nearly always very expensive in the amount

of gas it consumes, even when provided with the arrangement known as the Thermostat valve, which shuts down the gas when the water in the container is heated to the desired temperature. Briefly, gas is only recommended as a means of heating water when it is used intermittently and not constantly.

Precautions when Leaving Home.

In connection with the water-supply, there is one very necessary precaution that should always be taken when leaving the house for any length of time. It specially applies to the seasons of the year when there is any likelihood of frost. The main cock outside the house should be shut to prevent water flowing into the house, and the cistern and hot tank and pipes should be emptied. The water in any pipe is liable to be frozen, and when this happens the water expands with an almost irresistible force. It will split any pipe, and when the thaw occurs a leakage of tremendous extent will go on continually until someone comes to the house again and makes an unpleasant discovery ! In such a case the damage caused may be very extensive and in these times very costly to repair, and it is all the more annoying when it is remembered that the damage and inconvenience might have been avoided by shutting a stop-cock and turning on a few taps before leaving the house.

Bath Wastes.

When a new bath is fixed, one of the pleasures attending it is the rapidity with which the bath empties. By degrees this good quality goes, and if the waste pipe is not attended to, the water eventually drains away so slowly that it becomes a serious inconvenience.

In nearly every instance this is due to a gradual accumulation of soapy matter, which clings to the inside of the trap and waste pipe.

Sometimes a kettle of boiling water with as much soda as will dissolve in it will clear away the obstruction.

But it is generally advisable to clean out the trap and waste pipe.

There are many varieties of bath wastes, but in every case access is provided to the trap and waste pipe. It is generally a small cleaning plug screwed into the trap at its lowest point, sometimes at the side, but more usually underneath. On account of its position it is rather difficult to get at. By unscrewing this cleaning plug you will release a small quantity of water which lies in the trap.* When the waste has been cleaned, run a little water into the trap again by turning on the bath tap. This will serve the double purpose of showing you if you have screwed the plug right home and so prevented leakage, and also it will form the necessary " water seal " to exclude the sewer gas.

The best way to clean the trap is to use a piece of stiff wire with the end twisted round some pieces of rag, forming a swab. Dip the swab in soda and hot water, and work it vigorously up and down in both directions. The obstruction will be quickly swept away, and the water will run out as rapidly as when the bath was first put in.

In one form of bath waste a brass rod projects out of the flat piece at the end of the bath where the taps are fixed. To empty the bath you raise the rod and give it a quarter turn, when a projection on the rod will hold it up. When the rod is in this position, the plug should be raised from its seating and the way to the waste pipe should be open, but it sometimes happens that the plug becomes detached from the rod, and so cannot be raised.

In a bath of this kind there is generally provided a small grating at the end of the bath, inside, which gives access to the plug. By loosening the screws, the grating can be removed and the necessary repair made. If no such grating is provided, it may be necessary to remove the brass plate, also screwed into position, through which the rod works up and down, when the rod and the plug can be drawn up through the opening.

* See Chapter III., p. 35, and Fig. 11.

Leaking Pipes.

The water pipes usually found in our homes are made either of lead or of iron. Each of these is subject to leaks.

The former are fixed with what is known as a " wiped " joint. The two ends of the pieces of pipe to be joined together are brought close to each other, and are united by applying a mass of solder round the joint, which, when completed, has the appearance of a swelling in the pipe. It is a piece of work in which the plumber very properly takes pride. A leak at such a joint is unusual, because there is perfect combination between the surface of the pipes and the solder, forming a homogeneous mass. If a leak should occur, it will be because the joint was imperfectly made, and in this case the services of a plumber are required to remake it.

But sometimes a leak will start in the pipe itself. A small defect in the material of which it is made will show itself. It may be a pinhole or a small split, or it may be more serious, as in the case of a burst caused by frost. These can often be repaired in the following manner:

The water should be let out of the pipes. This can be done by shutting off the stop-cock in the rising main, or, if there is no such convenience, by tying up the ball-valve or plugging the orifice in the cistern.

The most important part of the proceeding is to get the pipe thoroughly dried, not only outside, but inside too. To do this, the best way is to heat an ordinary iron to about the same temperature as for ironing linen, and to rub it up and down slowly over the part of the pipe where the leak is. By this means the pipe is gradually heated up and the moisture inside is dried off. When the pipe is thoroughly dry, the repair can be successfully carried out in the following way:

Cut a strip of closely woven canvas, or old bed-ticking if it is quite sound, sufficiently wide to cover the hole or split, with an inch to overlap at each end, and long enough to wind about six times round the pipe. Cover one end of this with a cement made up as follows: Mix 1 part by weight

of shellac with 3 parts of methylated spirit. Keep on stirring until it thickens into a paste of the consistency of that used for hanging paper. This cement should then be applied to one end of the canvas, so that it entirely covers the damaged portion of the pipe, and far enough along the strip to make sure that the cement will go at least once completely round the pipe. The latter should then be heated up once more with the iron, and the canvas can then be applied, for the cement will adhere better to a warm surface. Press the cement-covered canvas firmly on the pipe, making sure that it fills up the split in the pipe. The rest of the canvas should then be wrapped firmly round and fastened securely with string.

To finish it off, thin out the remainder of the cement by adding methylated spirit until it forms a kind of paint. This paint can then be applied to the outside of the finished wrapping, and allowed to soak thoroughly into the canvas, which should be allowed to dry before turning on the water again.

A temporary repair can also be made to an iron pipe in the same way. But an iron pipe cannot be heated up with an iron so satisfactorily as a lead one can. The best way to heat an iron pipe is to use a blow-lamp. Although it is very useful for several domestic purposes, a blow-lamp has not been included in the list of simple tools. One can usually be borrowed from a friendly ironmonger or builder, but it is not an easy apparatus to use unless one is familiar with it. A small spirit blow-lamp, the "Tinol," may be obtained for 1s. 6d.

A temporary repair of a fairly large split in a pipe can be effected by wrapping round it a piece of old rubber tobacco pouch (a modern oiled-silk pouch will do), then winding a piece of tape or a strip of calico over this, and binding the whole with string, like the handle of a cricket-bat. If this is carefully done, with the coils of string closely in contact, it will last quite a long time. A strip of old bicycle "inner tube" is also very effective for the purpose, provided it has no puncture in it.

Water Taps which Make a Noise.

There are some taps which are very noisy when water is being drawn off. The condition which is essentially responsible is a water-supply of high pressure. A drinking-water tap on the rising main, and sometimes a tap in the lower part of a very high building, will set up a noise when the water is turned on, that can almost be compared to the rattle of a machine-gun. Although the reason for the noise is not very clear, the means of preventing it are simple. All that one has to do is to remove the washer and fit a new one. But the washer must be a stiff one,

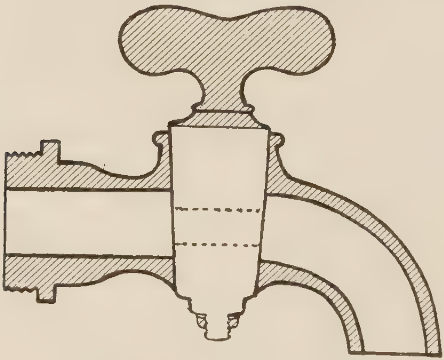

FIG. 10.—PLUG-COCK TAP.

either of hard leather or of the red or black fibrous material which can be obtained at any ironmonger's. The soft and pliable type is not suitable. For instance, the kind known as "valvine," very good in any other case, is sometimes responsible for the noise with a high-pressure supply. When a tap that is usually quiet suddenly starts to make the noise, it usually signifies that the washer has worn thin, and must be replaced by a new one.

The noise known as "water-hammer," which sometimes occurs when no taps are turned on, can be stopped by first turning on any tap on the system, and then turning it off *slowly*.

A similar noise is sometimes caused when the tap has the jumper attached to the spindle. It is attached in such a way that it can turn round, and it must be free to revolve, or the washer would be ground away in no time; but after a time it becomes too loose through wear, and a space develops between the flange of the jumper and the bottom of the spindle. This can be cured by winding a piece of soft copper wire (iron wire will rust) in the groove, so that, though it is fairly tight, the jumper will still turn.

There is another kind of noise which sometimes occurs when a tap is shut off suddenly. This is not so troublesome, because it is only one sharp metallic sound at the moment the tap is turned, and is not continuous. The sudden stopping of the flow of water is the real cause of the noise. This can easily be avoided in the ordinary type of screw-down bib-cock—in fact, it is difficult to cause the noise at all with a tap of this kind. But there is a bib-cock, known as the plug-cock, in which it is only necessary to give the handle a quarter of a turn to alter the tap from "full open" to "shut." Fig. 10 illustrates what happens when the plug is turned, and it will be seen how sudden the change may be. The way to avoid it is to turn the tap more slowly.

CHAPTER III

DRAINAGE

We have so far only dealt with the water in its clean condition, in the condition in which it is supplied by the Water Company. After its use in the house for various purposes—drinking, washing, flushing, etc.—it becomes in turn the principal part of the sewage, which is carried away through the waste pipes and drains into the sewers of the town. The clean water is brought to the various points in the house where water is wanted, and at each point we find some kind of tap, which is controlled either by hand—as, for instance, the bath tap or scullery sink tap—or by the water itself, when it operates the floating ball-valve in a cistern or Waste Preventer. Each of these points is provided with a waste pipe to carry away the used or surplus water, and the waste pipes are connected directly to the drainage system; it is therefore of the utmost importance to the health of the members of the household that these connections should be of a perfectly sanitary kind. The chief and most important thing is to prevent the unhealthy and evil-smelling gases which arise from sewage from coming up the waste pipes into the house. For this reason every lavatory basin, bath, sink, water-closet, urinal, and slop sink is fitted with a "trap" of some kind. There are many forms of trap, but the principle in all of them is the same. A small part of the outflowing waste water remains in the trap, and by its presence seals the drain, cutting off all connection between the air in the drain and the air in the house.

The lead trap found under every sink will most easily illustrate the principle.

The water comes down the pipe from the sink, fills up

the bent portion of the trap, and overflows down the pipe to the drain. The illustration shows how the water seals the pipe and excludes the sewer gas.

At every point of connection in a house there is some kind of trap which forms the water seal, and finally, when all the branches of the drain have been brought together under the ground; there is another trap interposed, sealing off, with a water seal, the sewer below the road.

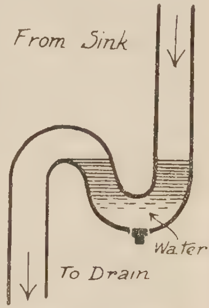

Fig. 11.—Sink Trap.

The attention of every householder is directed to these traps. They are the vital spots in a house, which must not be neglected. They must be kept clean, and care must be taken that there is always water in the trap to form a seal, because the seal is the only barrier between the sewer gas and the house.

It will be well to take each kind of trap separately, pointing out how each must be dealt with.

Sink Trap.

Usually of drawn lead pipe, as illustrated. Constant use generally insures that water is always in the trap, and so the water seal is good. The trap is liable to become coated inside with fatty substances, threads of dish-cloths, etc., which should be removed from time to time. If left too long, the fat decomposes and causes an unpleasant smell in the house. To clean the trap, dissolve 1 pound of soda in a quart of boiling water, and pour the mixture into the waste. See that the tap does not drip, and so carry away the solution before it has had time to be effective. Allow the solution to stand in the trap all through the night, and thoroughly flush out next morning. Unscrew the cleaning plug, which will be found at the bottom of the bend, and scrub the inside of the pipe with a wire brush. Replace the plug and fill the trap again by turning on the tap.

It sometimes happens that a discharge of one trap will "siphon" the water out of another. This is very liable to happen to a trap on an upper floor, when a fitting below is connected to the same waste pipe. The best way of detecting it is to listen carefully at the upper fitting while the lower fitting is discharged. If the siphoning action occurs, a distinct bubbling sound will be heard. It is also not unusual when two sinks or lavatories are side by side on the same floor. Careful listening will reveal the fact. The only remedy is to call in the plumber, who will provide an air inlet, called an anti-siphon pipe, on the waste pipe below the trap, but with its upper end above the level of the highest trap in the house. The air may be brought either from the outside of the house or from an extension of the waste pipe itself, which is carried up above the eaves of the house.

When leaving the house for a long time, such as a summer holiday, pour a small amount of glycerine into each trap. This will greatly reduce the rate at which evaporation can take place. If the water evaporates, the water seal is broken, and the sewer gas, which is much lighter than air, is free to enter the house.

Lavatory Waste-Trap.

Usually made of lead, as in the sink waste. It should be treated exactly in the same way as the latter. The soap used in washing causes a deposit of soapy slime, which must be cleaned out occasionally with the soda solution.

Bath Waste-Trap.

Formed either of vitreous enamel or of brass. It should be periodically cleaned with the soda solution.

Water-Closet Trap.

Generally formed of earthenware, being part of the closet pan, but it is sometimes made of lead. It must be

kept clean with the usual closet brush. When a water-closet pan has become discoloured by deposit, some spirits of salt (" muriatic " or hydrochloric acid) should be poured into the water and allowed to stand for a short while, after which the pan should be flushed out several times in the usual way. The portion of the trap which cannot be seen when looking into the closet pan is generally self-scouring, and needs no special cleaning. This trap should also be sealed with glycerine if the house is to be left.

Slop Sink.

This should be treated in the same way as the water-closet.

Rain-Water Gullies.

In addition to the traps of the ordinary sanitary fittings of the house, the rain-water pipes discharge over gullies which are also connected to the drainage system. Gullies are also provided to carry off the rain-water from areas and sometimes from baths. These gullies are trapped in the usual way, and are liable to become unsealed in long spells of dry weather. Under these circumstances, it is as well to pour water into them occasionally. The grids which cover the gullies should also be cleared of dead leaves and refuse which collects on them. If they are left too long uncleared, the rain-water cannot get away, and so overflows and is soaked up into the brickwork of the house walls.

Yearly Cleaning.

It is a wise plan to arrange for a yearly cleaning of the house drains and gutters, when all the traps should receive attention. A thorough cleansing once a year will usually keep them clear. But it is very important to see that the traps do not become unsealed by the evaporation of the water in them. This may happen in any gully in periods of fine weather, and in any internal lavatory or sink trap which for any reason is not regularly used. The main-

tenance of the water seal is so important that some individual should be made responsible for it. These traps constitute what may be called the second line of defence against the sewer gas, and by neglecting them everyone within the household is subjected to a serious risk of illness.

Every tap in the house, especially the stop-cocks, should be turned from time to time, for if left undisturbed they will stick fast, and so will not be available when they are wanted. All that is necessary is to turn on each tap for a few seconds.

Dampness in Walls.

Dampness in a house may arise from several causes. In old buildings there may be no damp-course in the brick walls. In such a case, whenever there is water lying about the building, or if the subsoil is a wet one, moisture will be drawn up by capillary attraction, and sooner or later a damp patch will appear within the building. When the dampness is due to this cause, it is almost impossible to remedy it. There is certainly nothing that a householder can do for himself that is likely to be of much permanent use in the way of a cure. But by the opening of windows and well airing any room that is so affected, and especially by making sure that there are gratings or air-bricks which will admit air under the floors, and that such gratings are not obstructed, one can to some extent evaporate the moisture, and so keep the room in a healthier condition. Fortunately, at the time when buildings were erected without a proper damp-course, before the local authorities were armed with compulsory powers by the introduction of the various Building Acts, it was very usual to build houses with basements. The height to which moisture can be drawn up by any material depends on a natural law, which is governed by the nature of the material. It is unusual to find dampness due to capillary attraction above the level of the ground floor. When the house has a basement and basement rooms, which are not regularly used as living rooms, the best advice one can offer is to keep them as well aired as possible,

and put up with the disfigurement of the decorations. If there is sufficient reason for having the dampness prevented, then it will be necessary to call in outside help. It can be regarded as a general rule that dampness which arises either from the absence of, or defect in, a damp-course requires skilled help to deal with the difficulty.

It frequently happens that dampness appears in other

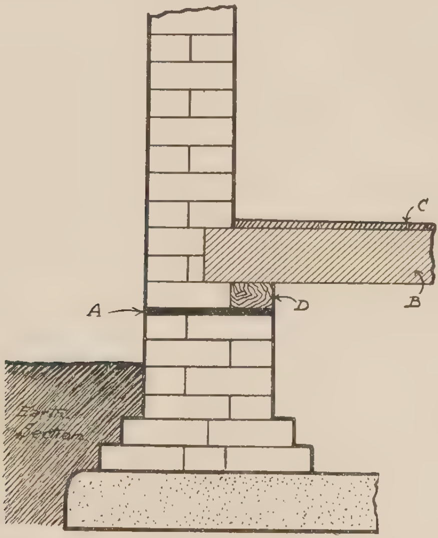

FIG. 12.—DAMP-COURSE.
A, Damp-course; *B*, joists; *C*, floor-boards; *D*, wall plate.

parts of the brickwork of a house, well above the ground level. In these cases it has nothing to do with defective damp-courses or moisture being drawn up from below.

It may be an indication that gutters and rain-water pipes are broken by frost or accident or require cleaning. If leaves and rubbish choke up the gutters, the water cannot escape quickly in heavy rain, and the result is the gutters overflow. Under these conditions the moisture soaks

through the brickwork. If the gutters are thoroughly cleaned, the dampness will gradually dry out of the wall. It may also be due to a leaking joint in the gutter or pipe. Such a leak can be repaired without much difficulty. Cast-iron gutters are made in 6-foot lengths, and these are fastened together by a small bolt which passes through each at the point where they overlap. One end of each length is shaped to receive the end of the next length. When a leak is located at a joint in the gutter, the nut must be unscrewed and the bolt withdrawn. The bolt in the next joint, either to the left or to the right, must also be withdrawn. This will leave one length of guttering free to be removed. The red-lead packing must then be carefully scraped away from both the joints which have been disturbed, and a thick coat of paint should be applied, and fresh lead pressed over to form a sealing. The gutter can then be replaced, and the bolts (it is generally advisable to fit new ones) fitted in and tightened up. Red lead, which is generally made of part red and part white lead, ready mixed for this purpose, can be obtained from almost any ironmonger or plumber. About $\frac{1}{2}$ pound will be more than sufficient for making good the two joints.

Rain-water pipes occasionally become blocked and leak through the joints, causing dampness in the walls. This is very likely to happen when the pipes are carried straight down into the ground and connected directly to a drain. It is perhaps unnecessary to say that no rain-water pipe should be carried down in this way. The pipe should end a few inches above the ground, and discharge through a proper cast-iron shoe over an open gully. But they are very often connected in the improper manner described, and in consequence are very liable to become choked up with dead leaves and dirt, washed down from the roof by the rain. The stoppage generally occurs at the bottom of the pipe, at the point where it turns to enter the drain.

The only way to clear it is to take the pipes down, and as, on account of the method of fixing, it is necessary to start taking them down from the top, it is sometimes rather a serious undertaking. This is especially so in a

high building. Obviously, the best thing to do is to have them altered and made to discharge over a gully. When this is done, the liability to become stopped is very much reduced, and even if a stoppage occurs, it can generally be dealt with from the lower open end of the pipe without disturbing any work.

Damage through damp may also be caused by defective lead or zinc-lined gutters in the roof, or by broken slates or tiles. In this case it is generally necessary to call in a builder to do the repairs for you. Again, it may be due to defective "pointing"* in the brickwork, but this, again, is hardly a job which the amateur can tackle effectively.

From the above remarks on dampness appearing on the inside of the walls of a building, it may be laid down as a general rule that when the dampness appears to be rising up the wall from below it is probably the result of a defective damp-course, which cannot be dealt with by the householder himself; and when the dampness appears to be soaking down from above, it may be within the power of the householder to dispose of the cause without seeking outside help.

* "Pointing" is the process of applying a special fine mortar or cement to the joints between the bricks, to prevent the rain from soaking into the coarser mortar with which the wall is built.

CHAPTER IV

HEATING AND VENTILATION

The ideal conditions for our external heat-supply are only really possible out of doors. The heat that is best for us is what is called "radiant" heat, the heat which comes directly from the sun's rays, and the air which surrounds us should be cool moving air. With plenty of radiant heat we can exist comfortably in air of almost any temperature, if only the air is moving. The actual temperature of the air is comparatively unimportant. Everyone knows the wonderful feeling of physical fitness and comfort that is experienced in really cold weather, if only the sun is shining brightly. Those who have climbed the snow-clad mountains in winter, with a temperature right down below freezing-point, know that the heat from the sun counteracts the feeling of cold, and that one needs but light clothing to be warm and comfortable.

With hard physical exercise, a normally healthy person can keep warm even when the thermometer is down to zero. But the fact that always arouses comment is that, provided the sun is shining, one can feel warm and comfortable in air of low temperature with the gentlest walking exercise, or even when sitting still and clad in light summer clothing. This fact is certainly at variance with our general ideas on the subject; but on looking further into the matter other facts arise, also of unexpected significance. The modern dress of women is certainly a case in point. A man will turn up his overcoat collar and shiver in sympathy when he sees a girl walk by in winter with a low-necked dress. But the girl does not feel the cold. She is warm and comfortable. The chest and neck, she finds, can be exposed with as little

inconvenience as her face. Although at first people regarded the adoption of the "pneumonia blouse" as a foolhardy and dangerous thing, there is a growing consensus of medical opinion that those who adopted it are not only none the worse, but are even better for the change. It is certain that many who have adopted it, and who were formerly subject to colds, have found themselves strikingly better in this respect. Another point which seems to complicate the subject is that two people sitting in the same room may at one and the same time be subject to different feelings: one complains that the room is too warm, while the other finds it chilly. Here we have a case which seems to show that the feeling of personal warmth may be unconnected with the temperature of the surrounding air. Another fact is worth mentioning. When a person begins to be ill, and feels his indisposition just starting, he may find, on taking his temperature, that he is feverish, and yet he nearly always feels chilly as well—showing in this case that one may feel chilly although one is actually warmer than usual. There is yet another strange fact that bears indirectly on the subject. In very cold countries, under winter conditions, a visitor from a warm part of the world can be out and about without suffering from the cold, whereas the native, or anyone who has lived there sufficiently long to become what we call "acclimatized," will feel the cold so keenly that he will not venture out unless it is absolutely necessary, and then only when clad in furs. The common explanation of this is that living in these cold climates causes the blood to become "thin," which makes one more sensitive to the cold. Again, an air movement which would rightly be called a "draught" inside a building, and consequently dangerous to some people, is considered merely a refreshing breeze when encountered out of doors, where the same people would enjoy and derive benefit from it.

From this apparent conflict of evidence, it is difficult to determine the temperature that is most wholesome for us in our homes, and what is the best means of providing it. What is the healthiest method of house-warming?

There seems to be no doubt at all in anybody's mind that we feel better and are better out of doors in warm sunshine and cool moving air than in a heated atmosphere within four walls. It would seem reasonable, then, to assume that any method of heating which approaches most nearly to the former conditions is the best from the point of view of health. Keeping this in mind, the old-fashioned open fire still seems the best imitation of outside conditions. The warm rays are there, for in an open fire practically the only heat that gets into the room is the radiant heat from the glowing fuel, and from the heated surfaces which are near it. The air movement is there, assured by the strong demands of the burning fuel for oxygen. The cool feeling of the moving air is apparent to all. It seems that all the essential conditions are there, and yet the method has its well-known objections. In what way can this very general method of house-warming be modified? Taking the objections in detail, we have the extravagant use of fuel and the very cold draught that sweeps along the floor surface towards the fireplace. The first is indeed a serious objection. The actual heat that is wasted in an open fire is something between 80 per cent. and 90 per cent of the total heat contained in the fuel. The large volume of smoke which rises from the fireplace consists of unburnt carbon, and, being unburnt, it has not given out any of its heat. You can watch the little discharge of the gas as it rushes out from the distilling fuel. Sometimes it is lighted up for a moment or two into a little burst of flame, only to be quenched again by the low temperature of the air which sweeps over the fuel up the chimney. It is here the great waste lies. The temperature surrounding the fuel is too low for complete combustion. To secure this, the coal must be burnt in an enclosed fire-box, where all the air that is required for the proper combustion of the fuel is drawn in through the fire-bars below the coal.

The draughts which sweep towards the fireplace have been mentioned as the other drawback to the open fire. And yet we know that the combination of cool moving air and radiant heat is the condition necessary to provide

healthy heating. Wherein, then, lies the objection to the air movement in the case of our open fireplaces? It is that the atmosphere in which we are sitting is composed of two streams of air of different temperatures. What we call a "draught," and regard as a thing to be avoided, is in reality a stream of air colder than the air through which it is passing. Our bodies are wonderfully capable of adjusting themselves to their surroundings, quite apart from any effort of our wills. But they cannot make the requisite adjustment for two different air temperatures at the same time. Out of doors we never experience "draughts." There all air movement is a pleasant, exhilarating experience. It is good for us. It is only indoors, with the means of heating we are discussing, that the complication arises which is not good or comfortable. There are, however, certain measures which can be taken that are steps in the right direction, and it is the purpose of this book to point them out.

In temperate weather, when it is sufficiently cool to make a fire desirable, we do not feel much inconvenience from draughts. If the difference in the temperature of the surrounding air and the stream we call draught is not very considerable, the latter is neither noticeable nor dangerous. In such conditions we can enjoy our fire and still leave windows open. But when the weather is too cold for this, we can adopt—if the windows are the common type known as Sash Windows—a very simple ventilating arrangement shown in the sketch, and so arrange for the incoming air to flow in such a direction that it does not impinge on anyone who is occupying the room. The arrangement was suggested many years ago by a Dr. Hinkes Bird. It is so good and so simple to make that it is remarkable that it is not more generally used than it is. It consists of a piece of wood of the same length as the rail of the sash. Its thickness does not matter much, as its only purpose is to keep the wind out; a $\frac{3}{4}$-inch board from 4 inches to 5 inches wide will do very well. It is fitted across the bottom of the window opening, and so prevents the lower sash from being completely shut

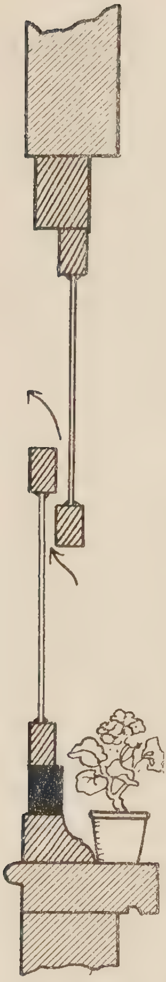

FIG. 13.—HINKES BIRD VENTILATOR.

down. It excludes air from the bottom of the window, but allows it to enter the room between the two sashes, as indicated by the arrows. The air flows in in an upward direction, and, instead of making a bee-line for the fireplace, becomes involved in the warmer air already in the upper part of the room, and joins with it in its slower movement towards the fireplace. By this means a cold draft is prevented, and the apparatus can be employed even in really cold weather. It has this further great advantage: whenever a fire is burning, a movement of air towards it, to supply the oxygen for combustion, is inevitable. The air will come from the source where it meets with the least resistance. There is very small resistance to the air current between the two sashes, and so it will come in by that way, and eliminate the cold draught along the floor, which would in other circumstances pour in under the door. To make doubly sure, it is easy to attach what is known as Draught-Stop to the door, and so make it difficult for the air to get in there. Draught-stop can be bought at any ironmonger's. The usual form is a small rubber tube covered with baize; in some cases the tubing is attached to a strip of wood, which is attached by small nails to the door. If the gap at the bottom of the door is too wide for the baize-covered rubber, there is a special draught-stop sold by most ironmongers. It is constructed roughly on the principle of a parallel ruler. The lower part projects at one end. It is fixed inside the door. When the door is

shut, the projecting end engages with the door frame, and is forced downwards, thus closing the gap. Another very good draught-stop consists of a roller covered with felt, held in two slotted brackets attached to the door. The roller can rise over the carpet when the door is opened, and will fall to the floor when the door is closed.

FIG. 14.—TOBIN TUBE.

Another means of admitting the air to a room in such a position that it will not create a draught is provided by what is called a Tobin Tube. This consists of a wood or metal tube, rectangular in section, carried up from the floor about 6 feet. There is an inlet cut through the wall near the floor line, and the fresh air flows in here and up the tube, thus entering the room in an upward direction. Coming in an upward direction, and overhead, it does not cause a draught towards the fireplace, but, as in the case of the Hinkes Bird Ventilator, the fresh air unites with the warmer air of the upper part of the room, and joins in its slow movement downwards towards the fire.

The Sherringham Valve and the Louvre Ventilator both

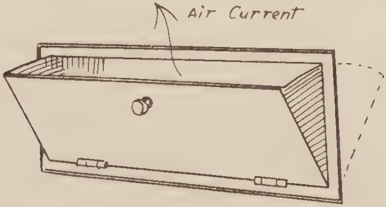

FIG. 15.—SHERRINGHAM VALVE.

give more or less the same result, but these, as well as the Tobin Tube, can hardly be installed by the householder

without outside help, whereas the Hinkes Bird Ventilator or the roller can. And as these are quite as effective as any of the others, they are recommended as a means of overcoming one of the principal drawbacks of the excellent open fire.

From the foregoing comments it will be gathered that what we should try to avoid is a cold draught entering the room at or near the floor. The reason why the cold moving air is so objectionable in this position is that cold air, being heavier than warmer air, will, when it is near the floor level, maintain itself as a separate stream distinct

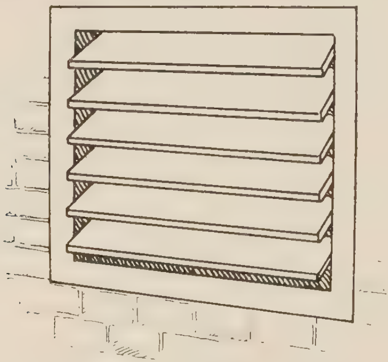

Fig. 16.—Louvre Ventilator.

from the air already in the room. If, on the other hand, it enters the room at a good height and in an upward direction, its momentum will tend to carry it upwards, while its heavier weight will tend to bring it downwards, and the ultimate result is a very complete mingling of the incoming air with that already in the room. It will lower the internal air temperature slightly, but its individuality is lost, and it is no longer what we call a draught.

There is one other step that can be recommended for increasing the comfort of a house, where the warming is done by open fires. If it is possible to fix an anthracite stove in the entrance-hall, its effect is felt all over the

house. The difficulty is to find a flue to which the stove can be connected. In some of the modern smaller houses a fireplace in the entrance-hall is already provided, in which case the anthracite stove can be fixed without any difficulty. But in many houses which have not this convenience it is possible to connect the flue pipe of the stove to the chimney of one of the fireplaces in another room. Outside help is indispensable for this, as it cannot be regarded as a "home repair," but it is mentioned here because it is of such great value in connection with open fireplaces. In a well-set anthracite stove the combustion of the coal is very complete. It eliminates waste to a very great extent, and can also be kept burning all through the night without any attention. This is, however, only one of its many advantages. It gradually warms the hall, passages, and staircase, and keeps them warm, and does not allow them to cool down during the night. The great advantage of this is that it does not become a matter of vital importance to shut the doors of the occupied rooms. The air-supply to the open fireplace in the room may well be drawn from hall or staircases, provided the air drawn in is approximately at the same temperature as that in the room. It does not constitute a draught, as we have defined it in this discussion. It will also be found that fires inside the rooms need not be so large, and the cost of the fuel burnt in the anthracite stove can be more than saved by the reduction of the fires in the rooms. On these grounds, and the greatly increased comfort of the house, the adoption of the anthracite stove is more than justified.

It is rather beyond the scope of this book to do more than refer to the other methods of warming buildings. Should any householder wish to instal any such system, it may be valuable to have a short general description and a few comments on the relative advantages of each.

Known under the general term Central Heating, the method of each is to generate the heat at one point, and distribute it to the various parts of the dwelling. Water, steam, and air are all used as the means of conveying the heat. The most general system and, in this country of

moderate temperatures, the most desirable is that in which hot water is used for this purpose.

The water is heated in a boiler with an enclosed furnace. Coke or coal can be used, the former having the advantage of producing less smoke and soot. The modern type of cast-iron sectional boiler is the best. Its great advantage is its high efficiency. From 70 per cent. to 80 per cent. of the heat given out by the fuel is absorbed into the water, and so contributes to the warming of the house. By the proper arrangement of the pipes, a circulation of the heated water throughout the system of pipes and radiators is obtained by the difference in weight of the water when it leaves the boiler at a high temperature, and its greater weight on its return to the boiler, having given out its heat. This is called the Gravity System of hot-water heating, and it is the best. There are other means of obtaining the circulation of the water, in which some form of pump is used. But in no case should a pump be used unless there is some detail in the construction of the building which makes it impossible to obtain a circulation by gravity.

The principal defect of a hot-water heating system is that the heat is given out by warming the air, and not by direct rays of heat, as in the ideal conditions described at the beginning of this chapter. You do not get radiant heat and cool moving air. The air near the radiators and pipes is warmed by contact with the hot metal surfaces, and a current of warmed air is set up, which gradually conveys the heat throughout the building. In its favour it has two important features. It does warm a building very effectively, and it is very economical in its fuel consumption. The absence of draughts is also an advantage. But it is the economical use of the fuel which is its greatest merit, and at no time in our history has this feature been of more importance. It is sometimes applied to the hall, passages, and staircases of a house, and, in conjunction with the open fires, to the rooms. In places where a good supply of wood is available, log fires in the grates with radiators in the other parts of the house make an excellent combination.

Gas-heated radiators are sometimes used, but they are unhealthy and expensive.

The open gas fire is a far more satisfactory means of heating by means of gas than the gas "radiator." It combines the principal advantages of the open coal fire with the added convenience that it can be lighted and turned off at will. For all purposes of intermittent heating it can be recommended. It is only in the dwelling-rooms of a house, where constant heating is required in cold weather, that the cost of the gas makes the use of a gas fire an expensive luxury.

Hot-water radiators, heated by electricity, have recently been used. There are features about them in their favour, but for constant and general heating the cost of the electric current is prohibitive. The better-known form of electric radiator in which the heat is given out from glowing lamps is, from the point of view of healthfulness, much more desirable. The conditions here are very like the sun's warmth, and their appearance is cheery. The radiators are movable, and one can sit and work comfortably in a low temperature with the warm heat rays from the radiator neutralizing the feeling of chilliness which would be so evident without them. They are not good for warming a room, the cost of the current is too heavy, but an individual can warm himself in a cold room with a radiator of this kind at a fairly reasonable cost.

Steam is sometimes used as the heating medium, instead of hot water, but this is not desirable for private houses in mild climates. It should certainly not be adopted in a country like England.

Heating by hot air is sometimes used, but it is not comfortable for houses, and is very much opposed to the best principles of healthy heating.

Before leaving the subject, it may be well to refer to one feature of all heating systems which is not, as a rule, clearly understood. The humidity of the air is important to our health, and has an influence on the comfort of a room in conjunction with its mere temperature. If the air is very dry, its capacity for picking up moisture is very great.

It seeks moisture and evaporates it with an avidity that is remarkable. The amount of moisture air can hold increases with its temperature. It has been found that a given volume of air at a temperature of 40° F., holding in suspension all the moisture it is capable of containing at that temperature, which condition is known technically as "saturation," is able to absorb, if its temperature is raised through a range of 20° F., twice as much moisture as it held at the lower temperature. This means that air which is completely saturated at 40° F. becomes only 50 per cent. saturated when its temperature is raised to 60° F., assuming, of course, that there has been no water for it to absorb in the process of warming. Now, air which is only 50 per cent. saturated is in effect very dry air—drier, in fact, than is good for us—and if the range of temperature is greater than the 20° mentioned, its dryness is, of course, greater. From this we can see that when we warm our homes in very cold weather we tend to surround ourselves with very dry air. This is particularly the case when we attempt to make ourselves comfortable by means of warmed air. We create an atmosphere that is very unlike the natural outside atmosphere, which is obviously the one in which we were intended to live. The air seeks to modify this condition by absorbing moisture with the avidity we have referred to. A mild attempt is sometimes made to supply its demand with a small vessel containing water; but the surface of water so exposed to the heated air is so small that it fails to meet the demands put upon it, and the air seeks for moisture elsewhere, and it gets it from our bodies. The natural moisture given out by us in the form of perspiration is seized upon and evaporated on the skin. When water is evaporated, heat is used up in the process, and the consequence is, that there is a loss of heat from our bodies, which produces an effect of chilliness. It will be noticed that we feel the chilliness quite irrespective of the actual temperature of the air. This theory has been offered as an explanation why people who live in very cold countries require a much higher internal temperature in their homes

than we find comfortable here. From 70° to 75° F. is a very usual temperature in American houses. They seek to neutralize the chilliness due to the dryness of the air by an increase in the internal temperature. It would be very rash to assume that they are unwise in their methods. All we can say with confidence is, that this high internal temperature is unpleasant to an Englishman, even when he is living there temporarily. It is a very significant fact that a temperature of 70° in our homes is very comfortable and pleasant to us in summer-time, when no artificial heating is necessary, and when, on the contrary, every inducement is made, by opening doors and windows to their fullest extent, to admit as much air from the outside as possible. We can thoroughly enjoy the 70° when the air has been raised to that temperature by natural processes out of doors, but it is quite a different matter if we have created an artificial inside temperature of 70° when the outside air is about zero. An inside temperature of 70° is very uncomfortable then, and it does not seem improbable that the discomfort is due to the dryness of the air. The little lesson that we learn from these considerations is to pay much more attention than we generally do to humidifying the air in our homes. Cut flowers in vases and open dishes and pots of growing plants are ornamental and charming means of adding to our comfort by giving moisture to the air we breathe. A kettle boiling on the fire and discharging its steam well into the room so that it cannot go straight up the chimney is an effective means of moistening the air. Doctors long since recognized the advantage of this in cases of bronchitis and other affections of the breathing apparatus, where the bronchitis kettle is put into operation, and for the same purpose we can spray the air from time to time with one of those fine vaporizing nozzles that are used for spraying scent. We frequently do these things in hot weather, but it seems certain that moistening the air is even more necessary in winter than in summer, for it is then that we have to some extent interfered with the natural laws, and thus we are inadvertently encouraging the approach of illness.

Before leaving this part of the subject, it is well to point out that the general impression that ventilation of a room can only be obtained if an open fire is burning is by no means correct. In a room heated by radiators, if there is an open fireplace, it will be found that there is a strong draught up the chimney. This can be detected by putting your hand near the open chimney, but it becomes still more obvious if a silk handkerchief is held out just above the fireplace. The lower part of the handkerchief is quickly swept back and pressed into the chimney opening by the strong rising current of air. This point having been settled, it enables one to look more favourably at the hot-water Central Heating system. And the chief objection to it having been disposed of, its good points may be emphasized with confidence. At the present time of coal shortage and enormous prices, it is important to remember that the quantity of fuel which we burn in one open fireplace is sufficient to heat five average-sized rooms by means of a Central Heating system. Also, that moderately heated radiators are constantly giving out warmth both night and day, and do away entirely with the cold rooms that we are accustomed to find in the morning in houses heated by open fireplaces. A Central Heating system of this kind also reduces the ordinary amount of house work, because it does away with the daily task of cleaning grates, lighting fires, and carrying coals and ashes up and down stairs, with the attendant distribution of dust and dirt about the house. There is also one other important advantage. When fuel is burnt in a closed furnace, the combustion is very complete, and in consequence there is practically no smoke. When we remember that it is the smoke from the many thousands of domestic chimneys in a large city that is the main cause of the fog we call "London fog," which is so unhealthy, inconvenient, and unpleasant, everyone will agree that every step which tends to reduce it is a step in the right direction.

Smoking Chimneys.

If a chimney, which does not usually smoke, suddenly develops the fault, it can be pretty safely assumed that something has blocked it up. It may be a large accumulation of soot; it may be that some of the pargeting (or mortar with which the chimney is lined) has fallen out of position, or it may even be a bird's nest or some quite foreign matter that has been put into the chimney.

In such cases as these a sweep will probably be able to put everything right for you.

There are some chimneys that only give trouble when the wind is blowing in a certain direction. In these cases there is generally some adjacent high building or a tall tree which causes a down-draught when the wind, rushing over them, comes pouring down in a kind of invisible torrent right on to the top of the chimney.

Here we are confronted with a real difficulty, and one, moreover, with which we can hardly deal without calling in help.

If the trouble is due to a tall adjoining building, the only way to cure it effectively is to carry up a galvanized-iron pipe, of the same diameter as the chimney pot, right above the eaves of the higher building. But where the trouble is caused by a *detached* building or a tall tree, there will probably be no means of supporting a galvanized flue strongly enough to prevent its being blown down in a high wind, unless it can be securely stayed with rods fixed to the roof. In this case the only thing to do is to call in a building firm of experience, and they may be able to suggest a suitable kind of cowl or pot which they have found effective in a similar case. The "Edwardian" pot, named after King Edward, is often installed with good results.

There are certain steps that can be taken which will assist a chimney where the draught is unsatisfactory.

What is known as a "blower" can be fitted in the fireplace. A blower is a sheet of metal—sometimes glass is used—which stretches from jamb to jamb of the fireplace opening, blocking up the upper part of the opening.

This blower makes it necessary for all the air that enters the chimney to pass through the fireplace nearer to the burning fuel. This makes the air hotter, and prevents cold air being carried into the chimney with the heated air and smoke from the fire. To determine how far the blower should come down, it is very easy to test with a piece of cardboard, or an old piece of linoleum. All that is necessary is to bring the blower sufficiently far down to confine the draught to a definite course which will prevent eddies that permit the smoke to enter the room.

A small sheet of uralite* makes an excellent blower. It will not burn, and can be painted with a water-colour paint to any desired tint.

Another remedy that often makes an ineffective draught into a good one is to provide a fresh-air inlet into the room. If the air can be brought through an outside wall below the floor and made to discharge through a small opening under the fire-basket, it will greatly improve the draught of the chimney.

* "Uralite" is a kind of slate artificially made from asbestos and cement.

CHAPTER V

COOKING BY COAL, ANTHRACITE, GAS, ELECTRICITY, AND OIL

Cooking Appliances.

The kitchen range is one of the most important of all fixtures in a house. It is also, as a rule, not thoroughly understood by those who use it, and in consequence it is frequently a source of considerable trouble.

The designs of ranges are numerous, but it is safe to say that nearly all are constructed on more or less the same principle. They all have an enclosed fire, one or two ovens, and a boiler for supplying hot water.

The chimney to which the kitchener is connected must have a strong draught. As a general rule the draught in the kitchen is a strong one, because the kitchen is nearly always at the bottom of the house, so that the chimney is carried up right through the house before it emerges above the roof, and as the height of a chimney is one of the dominating factors in producing a draught, the one from the kitchen usually has this advantage.

The fire in the kitchen range is more often in use than any other in the house, especially when the hot-water supply is derived from it. The result is that the brickwork of this chimney is kept constantly hot, and heat is also another important factor in securing a good draught, for warm air is lighter than cold.

The result is that when the draught in the range is unsatisfactory, it is not, as a rule, the fault of a chimney.

If we thoroughly understand the construction of a range, it will greatly assist in finding out the cause of a defective draught.

The fire is usually between the boiler and the oven.

It may be a single-oven range with a side or low-pressure boiler, a single oven with a high-pressure boiler, or a double oven with a high-pressure boiler.

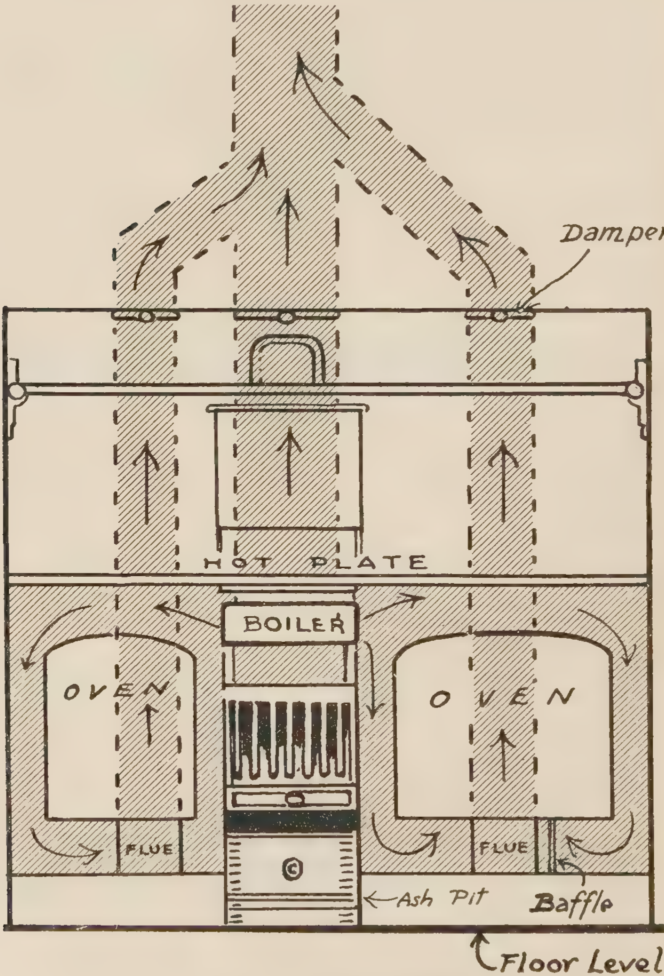

FIG. 17.—KITCHEN RANGE.

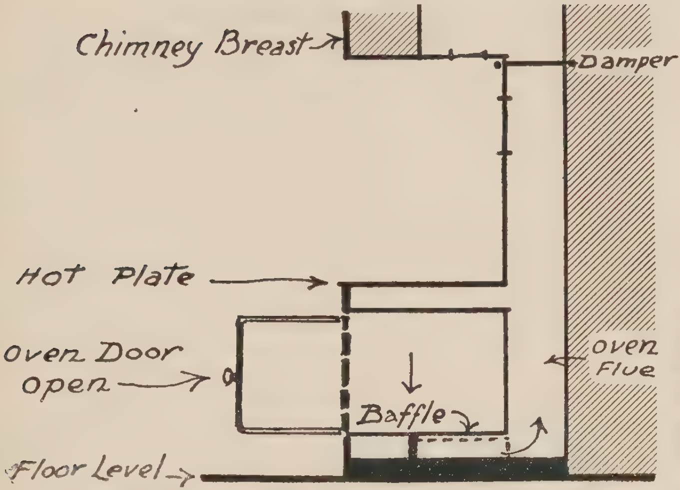

FIG. 18.—KITCHEN RANGE: SECTION AT OVEN.

In every case there are three flues which eventually discharge into the kitchen chimney. The all-important

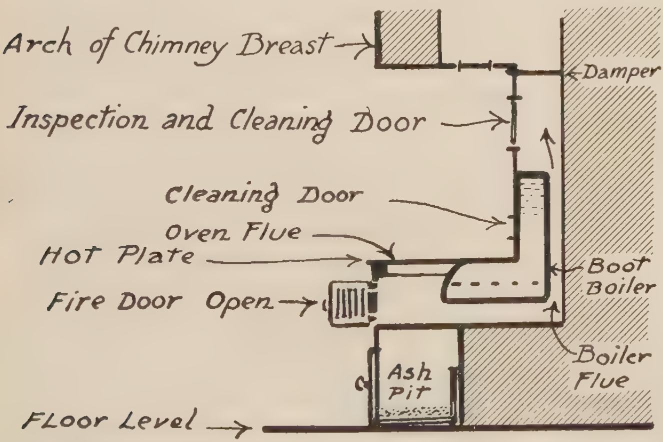

FIG. 19.—KITCHEN RANGE: SECTION AT FIRE.

fact is that all the air which passes through these flues must first of all pass through the fire. There must be no air leakage into the flues or the chimney from any other source, nor must there be any leakage from one flue into any other.

There is seldom, if ever, any difficulty in heating the water with a low-pressure side boiler. But with a high-pressure boiler, which is usually situated at the back of the fire, there is frequently trouble. A large amount of heat is inevitably given out by the pipes which connect the boiler to the tank or cylinder. Where a high-pressure boiler is installed, the flue passes under the boiler and up behind it into the chimney. If this flue is not thoroughly clean, the draught through it is impeded, and the water does not get hot. It is therefore of the utmost importance to see that the flue is quite clear. And by this is meant not only the part which passes under the boiler, but also the vertical part behind the boiler. The latter is very liable to be partly choked by mortar or brickwork which falls down the chimney. When, therefore, this flue is cleaned, it is important to make sure that there is no obstruction, either in the horizontal part below the boiler or in the vertical part behind. When the lower part is clear, it is a good plan to put a lighted taper under the boiler right to the back, and by removing the inspection door in the back plate, just above and in front of the boiler, you will be able to see the light from the taper, and satisfy yourself if the flue is clear or not. In cleaning the bottom flue, great care must be taken not to push the soot and dust to the angle at the back, but to be quite certain it is all pulled forward and out of the flue into the fireplace.

In the same way, the oven flues must be thoroughly cleaned. These flues start from the fire, over the top of the oven, then down on the side of the oven away from the fire, and under the oven to the vertical brick flue, which passes up the back and joins the others at the entrance to the chimney. Sometimes there is also a vertical oven flue, direct from the top of the fire and down the side of the oven nearest to it, which joins the other

flue at the bottom. Soot doors are provided to give access to every part of the oven flue, which must be cleaned daily, care being taken, as in the case of the boiler flue, to see that all the soot is raked out, and not pushed back to the far side. If, when all the flues are clean, there is still trouble through insufficient draught, then the remedy must be looked for elsewhere. In this case it is almost certain to be due to air leakage into the chimney.

First look for any missing parts of the soot doors or inspection eyes in the back plate. If these are all sound and properly closed, the best thing to do is to take a lighted candle and hold it to all the joints in the back plate, the covering-in plate above the range, and also the joints made with the brickwork at the top and at the sides. If there is a leakage at any of these points, the candle-flame will be drawn through. Sometimes there is a copper beside the kitchen range. The flue from this is generally carried up the side, and is connected to the chimney above the range. This flue should always have a well-fitting damper, and the damper should always be shut when the copper is not being used.

If no leakage is found in any of the above positions, it points to defective flues in the brickwork. Sometimes the brickwork behind the fire crumbles away as a result of the continued heat from the fire, and the brick divisions between the vertical flues do not make a close contact with the back of the range, which forms the front side of the three vertical flues, and the consequence is the air leaks from one flue into others, and the draught of the range is impaired. In this case the remedy consists of building new brickwork, and it cannot usually be undertaken without calling in outside help.

The Anthracite Cooking Range.

When a new cooking range is required, it is often very difficult to determine exactly what kind to instal. And it may be of service for the householder to know of an entirely new type in which the fuel used is anthracite coal.

One such range is known as the Kooksjoie, and it is well named; but there are other makes on the market, so their respective merits should be ascertained by inspecting them all.

The great advantage about the anthracite range is that the fire can be kept in throughout the night, and so it does away with the irksome duty of lighting the kitchen fire in the morning before any cooking can be done or hot water is available for the breakfast tea or coffee or morning bath.

The anthracite range is not extravagant in fuel consumption, as might at first be supposed. The means for regulation of the draught are very perfect, so that very slow combustion can be maintained. The oven temperature can be kept very constant, which is a great advantage for cooking.

The one disadvantage is that if the kitchen is small it is liable to become very hot, and this is undesirable for summer use. But if used in conjunction with a gas stove, or an electric cooker, it will be found to give very considerable added comfort in the house.

It can be used with other kinds of fuel, but the greatest service is obtained with anthracite coal. Not only can a fire be kept in for the longest time with this fuel, but the cleaning of the flues is only necessary about once in three months, and the sweeping of the kitchen chimney once in five years.

Full particulars of the Kooksjoie can be obtained from the London Warming and Ventilating Company, of 20, Newman Street, Oxford Street, London, W. 1. Smith and Wellstood, of Ludgate Circus, London, also have ranges which should be seen.

Gas Cookers.

The variety of these is very great, and it is difficult to advise what type to select. Under conditions brought about by the shortage of coal, it may be taken that the Gas Companies are all anxious to avoid waste. In these circumstances, perhaps the best advice that can be given

in selecting a gas stove is to refer the matter to the Gas Company supplying your district, and be guided by them.

There are one or two points which should be watched in order to reduce the amount of gas used to a minimum.

In boiling a kettle or heating any cooking utensil on the top of the stove, do not allow the flame to extend beyond the base of the vessel. Turn the tap off until the unnecessary spread of flame disappears, because it is not contributing to the work in hand: it is just waste of gas.

The shallow pan which generally stands on the floor below the oven is not intended to hold water. It is simply there in the interests of cleanliness. If you put any water in it, a part of the heat generated by the burning gas is taken up in evaporating the water, and, moreover, the moistened air in the oven retards and interferes with the operation of cooking. The air in the oven should be as dry as it is possible to get it. If water is put into this pan, the result is waste of gas.

Gas Taps which "Light Back."

All atmospheric burners, such as are used on gas stoves, are occasionally subject to "light back." It is immediately observed in the yellow colour of the flame and the roaring sound. If you examine the burner closely, you will find a flame at the end of the gas pipe near the fresh-air inlet where no flame should be. Turn out the gas at once, and light the burner again. If the same thing happens again, call in the Gas Company's man. It is not usual for the Company to charge for his services. The fault is usually due to the poor quality of the gas. It causes a deposit to collect in the pipes, which gradually chokes them, preventing a full supply of gas from passing. The pipes are quickly cleared by the gas man, and the difficulty is at an end. It may appear again after a lapse of time. Then call in the Company again.

Oil Cookers.

Modern oil cookers are generally of the "blue flame" type, in which, by the peculiar construction of the burner,

the oil is vaporized and (somewhat as in a gas stove) mixed with air before being burnt. These, if kept in proper order, give a cleaner and hotter flame than the old "yellow flame" type, and are much less likely to smoke. There are two chief kinds: (1) those with a tall chimney (or "long drum"), in which the flame is at the bottom of the chimney (10 or 12 inches below the vessel to be heated) and the heating is done by the strong current of hot air rising from the chimney; and (2) the short chimney (or "short drum") type, in which the flame is near the top of the drum and, when at full height, impinges directly on the bottom of the vessel. The Anglo-American Oil Company distributes stoves of both types, their long drum type being known as "Valor-Perfection," the short drum as "Valor-Puritan." The former type is in somewhat more general use in this country, and is particularly good when used with an oven for baking. It seems, however, to be much less efficient for boiling, unless the surface of the vessel used is very large, as much heat is carried past the vessel by the strong draught, and thus wasted. On the other hand, it is perhaps slightly more "fool-proof" than the short drum kind. Our advice would be that if the cooker is to be used by a person of intelligence, the short drum type should be chosen; if by the ordinary servant of to-day, the long drum type.

Electrical Cooking.

Cooking by electricity is an established fact, and certainly the method possesses some advantages. Some of the Metropolitan Electric Lighting Companies have started restaurants in London where electric cooking is done, and the opportunity is given to anybody who uses the restaurant to inspect the cooking arrangements. Such a visit is sufficient to demonstrate the cleanliness of electric cooking, and the cooked food certainly tastes very good; but it is very questionable if it is economical. Heat units derived from electric current are very much more expensive than those from coal or gas.

CHAPTER VI

DECORATING WORK

Decorating can well be undertaken by the householder. There is no great executive skill required. With a little practice, work of a very satisfactory standard can be carried out, and in some of the work, by carefully following a few instructions, the first attempt may do perfectly well for the less important parts of a house.

But apart from any amount of instruction, common sense must be brought to bear. For instance, whitewashing, distempering, painting, papering, may each and all be done on walls or ceilings or woodwork which may themselves be new and clean, or may have been whitewashed, distempered, painted, or papered before. While it is *nearly always* best to remove or strip off such previous decoration, you *can* superimpose new distemper on old distemper, or on old paper, or on old paint; you *can* paint over old paper, or even over old distemper—and so on. But if you expect a satisfactory result after, say, painting over a thick, absorbent, and embossed wallpaper, you have only yourself to blame if you find you use three times as much paint as you would have needed had you stripped, and if, after all, the pattern shows through.

As regards quantities required, 1 gallon of good paint should cover 100 square yards. Obviously, much depends on how thickly or thinly it is put on. In the case of distemper, the range is even wider: three different well-known manufacturers state respectively that 1 cwt. of their brand will cover 450, 640, and 900 square yards. But it is better to buy a little more than you require than not enough.

Whitewashing and Distempering.

Whitewashing resolves itself into three parts. First, the wall or ceiling must be "washed off." There is nothing difficult about this, but it is very hard work, especially when it is a ceiling that we have to undertake, and, above all, if the ceiling has been papered. Next the surface has to be prepared to receive the whitewash, and then the whitewash has to be applied.

The plant required for the work consists of a whitewash brush, a sponge, and a clean pail and water.

You will, of course, have to stand on something to reach the ceiling easily. In most cases a small kitchen table is high enough, and can be easily moved as the work progresses. If you have them, two pairs of steps and a stout scaffold board are best for the job, as the height can be easily adjusted, and you can cover a lot more ground without continually stepping down, moving your table, and stepping up again, which, when repeated many times in a day, is extremely fatiguing. When you are standing in position your head should nearly touch the ceiling. If you have to reach up with outstretched arm, you waste a lot of energy, and the whitewash soon runs down the brush along your arm! It is hard work at the best, and when you start you must keep steadily on without a rest until the work is completed.

First dip the brush in the water and apply it to the ceiling as far as you can conveniently reach; lay it on with the flat of the brush, taking care not to use it as one would a scrubbing brush, but work it to and fro carefully with a sweeping motion, using one side of the brush in one direction, and the other side in the other. By this method the brush is gradually "broken in," as it is called by the painter. The bristles are worn so that they form slanting sides, meeting at the end in a sharp edge. When the brush is worn into this shape it is much better for whitewashing than when all the bristles are the same length and cut off square.

Having thoroughly soaked the part of the ceiling within reach, take the sponge, not too full of water, and thoroughly wash off the old whitewash. As soon as one part is cleaned, move the steps a little and clean off the next portion, and so on until the whole surface has been dealt with. You will find it necessary to change the water in the pail from time to time.

When the ceiling has been thoroughly freed from the old whitewash, the windows and doors should be left open to hasten the drying.

If there are any cracks in the ceiling where the plaster has fallen out, they should be repaired at this stage. Keene's cement is best for this purpose, as it does not set so quickly as plaster of Paris. The crack should be brushed with a stiff brush to remove loose plaster, and, just before the cement is applied, should be soaked with clean water laid on and sprinkled well in with a whitewash brush. The cement dries very quickly, so only a small amount must be mixed at a time. It should be pressed into the crack with a small trowel or a putty knife, and left to dry. When dry, rub it down with a piece of pumice-stone which has been rubbed flat.

The next operation is to prepare the surface for the whitewash. To do this, what is really necessary is to fill up the pores of the ceiling to prevent suction when the whitewash is applied. For this purpose it requires a coat of Clearcole. Clearcole is made in the following way: Get about 3 or 4 pounds of size from an oilshop. You will find it a stiff, jellylike substance. Divide it up into small pieces and put it into the pail; heat it over a slow fire, and add boiling water until the pail is rather more than half full; then allow it to cool a little, and apply it with the brush evenly over the whole surface. Great care must be taken not to miss any part; if you do, that part will show when the job is finished. It is a good idea to put a little whitening in the pail when the boiling water is added. This gives a slight colour to the Clearcole, and enables you to see exactly where the brush has been.

The ceiling can now be left to dry, when it will be ready

for the whitewash. This should be prepared the day before it is required for use.

It consists of whitening, size, and water. For an ordinary ceiling you will require about 2 pounds of whitening. This you can buy at the oilshop. It will be handed to you in rather large lumps, which must be broken up into small pieces and put into a clean, dry pail. Pour in cold water sufficient to cover the whitening, and leave it to soak for about a quarter of an hour. Then mix and stir it until it forms a thick paste, making sure that there are no lumps left in it. If it is too thick you must add a little more water. The mixture should be thin enough to settle down with a flat surface on top, as a liquid does. But it must not be too "runny." The consistency of treacle is perhaps the best standard. To this mixture must be added about 4 pounds of size which has been melted, as before, in a clean pail over a slow fire, but without any water being added to it. Mix the whole up thoroughly, and leave it for at least twelve hours before using it, keeping it covered to prevent dust getting in. It is advisable to add a small quantity of dry powdered colouring material to give a slight tint to the whitewash. You will, of course, be guided in choosing your colour by the general tone of the colour of the walls. About three-pennyworth of ultramarine will give a blue tint; red ochre will give pink; yellow ochre will give a yellow tint; and Brunswick green is best for a green tint. The colouring should be added when the melted size is poured in, and great care must be taken that it is thoroughly mixed with the rest of the material. Recollect that the colour when the wash is *dried* will be different, and make a preliminary experiment to assure yourself of the right tint. The whitewash, when ready for use, should be of the consistency of a thin jelly.

In applying the whitewash the essential thing is to keep the part completed wet until the adjoining portion is done. If the edge of one section is dry before the next section is completed, it will show very plainly when the job is done. It is advisable, then, to shut the door and windows of the room, and, if the room is empty, to sprinkle the floor

with water. This will help to prevent the work drying too quickly. In doing the work, you will have to consider carefully where to begin. It would obviously be unwise to start in the middle of the ceiling, as the section you could reach would have edges all round. If the room is long and narrow, it is best to start at one end and work towards the other end. If it is square, it is generally most convenient to start at one corner and work across, step by step, to the corner which is diagonally opposite. In every case it is wise to work from the darker part of the room near the door towards the lighter part near the windows. You can see what you are doing much better if you adopt this plan.

It is well not to dip the brush too far into the whitewash. Two inches is the limit. Apply the mixture with the flat sides of the brush, working to and fro. It is also better to apply it in two directions, one at right angles to the other—first across and then in line with the direction in which you are working. By doing this, the brush marks are not so distinct when the work is dry. But the principal thing to which your attention must be constantly directed is not to allow the edge of one part to dry before the adjoining part is applied.

Only when the job is finished must you open the door and windows, and allow the ceiling to dry.

There is considerable risk of splashing the walls and allowing drops to fall on the floor. If it is not intended to renew the paper on the walls, prepare for this by covering it with sheets of newspaper fastened all round the room with pins, and any furniture which cannot conveniently be moved must be protected with dust-sheets.

Most of the foregoing instructions apply equally to *distempering.*

It, of course, saves a considerable amount of trouble if, instead of mixing your own whitewash, you buy a prepared distemper. There are many good brands on the market, and most of them will be found easy to work with and satisfactory in result. Some are procurable ready mixed, some in a paste to which water only need be added; others

in a powder, to be mixed either with water or some special "petrifying liquid" which gives the wall a surface subsequently washable. Carson's and Hall's, as well as those called Fillicol and Ceilingite, are very good, and can be bought at almost any oil and colour shop.

Papering.

If you are going to paper a wall that has already been papered, the proper course is to strip off the old paper. (This is equally true if you are going to paint or distemper it.)

For this purpose you will require a pair of steps, a pail, a sponge, a distemper brush, and a stripping knife.

Get a pail of clean water, and with the brush moisten the paper. It is better to start at the bottom and work upwards, taking one wall at a time. You will find the first application has not much effect, so it must be repeated over and over again until the paper is *thoroughly soaked* and shows signs of wrinkling and coming away at the edges. When this happens, you will find you can pull the paper away, and as much as possible should be removed in this manner. Some will no doubt stick to the plaster, and this should be removed with the stripping knife. You must be careful not to dig the corners of the knife into the plaster, as this will damage the surface. If more than one layer of paper is on the wall, you may have to repeat the damping process for each. When all the paper is off, the plaster should be immediately washed with clean water and a sponge, until all the old paste has been thoroughly removed.

The whole secret of successful "stripping" is to use *plenty of water;* a fine-rosed garden-squirt has been found useful. But beware what becomes of the excess of water: old pieces of linoleum may be put down if the floor is bare boards, and a rolled dust-sheet laid along the wainscot helps to staunch the overflow.

Proceed in the same manner round the walls until all the plaster is cleaned.

Any nail-holes or other breaks in the plaster should be stopped up with Keene's cement, and all made smooth with the pumice-stone rubber.

As soon as dry, the wall is ready for the paper. The amount required is simply a matter of measurement. English papers are sold in rolls 12 yards long and 21 inches wide. If the height of the wall from the skirting to the cornice is not more than 8 feet, you can reckon on cutting 4 lengths to the roll. If it is from 8 to 10 feet, it is well to allow only 3 lengths to a roll. If you take a 2-foot rule and hold it 3 inches from the end, you can quickly measure how many lengths you will require for the room, and, dividing this number by three or by four, according to the height of the wall, you get the result in rolls of paper required. This gives a full allowance for the inevitable waste which occurs in fixing the paper so that the pattern is continuous on adjoining lengths.

Having procured the paper, the next step is to trim it. For this you require a pair of scissors with long blades. Paperhanger's shears are about 12 inches long, but would be unnecessarily expensive for the occasional use to which you would put them. On both edges of the wall-paper is a clearly defined line indicating the portion which should be trimmed off. It is best to trim both edges and hang the paper with the joints closely "butted."

In "butted" work the selvedge on both edges of the paper is trimmed off, and the widths all lie quite flat on the wall, whereas in "lapped" work one edge only is trimmed, and the trimmed edge is pasted over the untrimmed edge of the next width of paper. The latter is a lazy way, and a good workman would scorn anything but a "butted" joint, though it requires considerable care to bring the edges closely into contact as the succeeding widths are pasted to the wall.

The quickest way to trim the paper is to sit on a chair with the roll resting across your insteps, holding the shears in one hand, and rolling the paper on your knees with the other hand as the edge is trimmed off. If you find this method irksome, another plan is to rest the roll on a table

with the end just over the edge, rolling the trimmed part with your left hand on the table. The roll may be laid on a chair-seat so that the paper presses against the far edge of the table as it comes off the roll, thus holding it taut while you trim the edge. The operation is rather difficult, as it is very important that the cut should be very clean and straight; considerable care is required, which makes the task slow at first. Having trimmed off one edge, you turn the roll round and trim the other. The experienced paper-hanger does this with surprising rapidity.

Having prepared the paper, we proceed to hang it. For this we require paste. This is prepared in the following way:

Mix about 3 or 4 pounds of common (*not* self-raising) flour with just enough cold water to form a thick batter. This must be thoroughly stirred and mixed until it is free from lumps. To this you add gradually about half a pail of water, either hot or cold, and mix it thoroughly as the water is being added. If you use hot, the water must be boiling, and you will require a large kettle or two or three smaller ones to contain the requisite quantity. If there is no gold, silver, or bronze in the pattern on the paper, it improves the paste to add a teaspoonful of powdered alum. This can be put in before adding the water. The important thing is to keep stirring the mixture while the water is being added, and afterwards until the paste thickens.

If you use cold water, stir the mixture well while adding the water, then add the alum and boil up the mixture, but keep on stirring all the time it is being boiled. In either case the paste must be allowed to cool before being used. If when it is cool it is at all lumpy, it should be strained through cheese cloth or canvas.

The paste being ready, take a roll of paper, and, if necessary, cut off a few inches so that you do not have the middle of the pattern with a row of headless birds or stalks without flowers at the top of your wall. Then cut off a length long enough to reach from ceiling to skirting-board, and an inch or so over. Lay the cut length face down on a table or on a couple of boards supported on trestles, and

put on the paste with a large brush (the whitewash brush will do), making sure that the paper is all evenly pasted. Double the paper lengthwise (the pasty surface inside), but not quite in the middle, leaving 2 or 3 inches at the top edge single. This will give you only half the length of the paper to handle, which you will find more manageable than the whole length hanging down.

Hold the top edge, mount the steps, and stick the paper straight against the wall, but a trifle too high up. The inner fold can now be helped to fall down into place. If the length does not hang quite straight, you can pull it away gently from the wall and adjust it where you want it to go, pressing it firmly to the wall with a duster or a brush, using long but gentle downward sweeps.

The top and bottom edges must be pressed back into the angles made between the wall and frieze and the wall and skirting, and marked by running the point of the scissors along the angle. Then pull the paper away from the wall, trim it with the scissors along these lines, and press it back into position again. In cutting the other lengths, be careful to make them long enough to make the pattern continuous from strip to strip. You will have to find out by trial how much to allow, as it varies, of course, with the kind of pattern. The best place to start is beside one of the windows, and to work round the room to this point again. Only paste one width of paper at a time.

Painting.

Painting is a perfectly simple operation, but one or two important points must be carefully observed.

Perhaps the most important is cleansing the surface to which the paint is to be applied. A door may appear clean, and yet be very dirty from the painter's point of view. It must be accepted as a rule that every surface is dirty from a painter's point of view, except newly-planed wood or fresh plaster. The "dirtiness" to which we refer is the greasiness which is always the result of contact of a hand. However clean our hands may be, we leave a little

grease whenever we touch anything. This is the reason why we fix finger-plates on doors. Before anything is painted, *this grease must be removed.* If we fail to do this, the paint will not dry properly, and the job is spoilt.

To clean painted woodwork, all we require is a clean pail of hot water in which a packet of soap powder has been dissolved. The best way to wash is to use an old scrubbing-brush. A toothbrush is very useful for getting into the angles and for the mouldings. The work must be vigorously scrubbed. When this is done, it must be well rubbed down with pumice-stone, taking care that all the little angles of the beadings and mouldings are rubbed. As far as possible, the pumice should be used by rubbing with a circular motion, just in the same way that a french polisher applies his polish. The pumice must be kept wet by constantly dipping it in the pail. When you are certain that the whole surface has been well rubbed over, rinse it with clean water with a sponge, and leave it to dry thoroughly. You must not apply any paint until it is *quite* dry. If you do, the paint will soon come up in blisters.

The next important thing that must be observed is to apply the coats of paint very thinly. Although it sounds like a contradiction, it generally takes less time to apply four thin coats of paint than two thick ones. The explanation is that the thick coat takes so much longer to dry. The top surface will harden and protect the underlying paint, which is thus prevented from drying. If the coat is put on very sparingly, it will dry quickly, and you are soon able to apply the next.

If you are painting anything that has been painted before, it does not, as a rule, require more than two coats, especially if you are using the same colour. If it has previously been painted a dark colour, and you wish to alter it to a very light colour, you may have to give it three or even four coats. But do not be tempted to apply a thick coat with the idea of saving time and trouble. Thin coats are best. The result looks far better, and lasts much longer.

The third important thing is to buy good brushes and paint material.

It is not wise to buy many brushes. For one reason, unless tools are frequently in use, it is difficult to preserve them. They must be kept in water, and they must not rest on their bristles. This means they must be suspended in some way with bristles just under the water. The stock into which the bristles are fastened should *not* be in the water. The usual method is to bore a hole through the handle and use fine cord or wire for suspending the brush. It is also necessary to add a little water from time to time to make up for that which has evaporated. If it is known that the brushes will not be wanted again for six months or a year, they should be thoroughly rinsed out in turpentine, then well washed with *warm*, not *hot*, soap and water, and hung up until they are dry. They can then be laid aside in any dry place. But even when these precautions are thought to have been taken, it is sometimes found that the brush has hardened, or that something has been pressed against the bristles, and they are twisted and bent.

For these reasons it is wise to get as few as possible. All the usual painting in an ordinary room can be done with one "No. 12 sash tool" and one "No. 4 sash tool." These can be bought " ground " into the shape that is best for the work. A new paint tool that has not been ground has a flat surface formed by the ends of the bristles. Before good work can be done with it, the bristles must be worn away on two sides of the brush, so that instead of the flat surface you have a chisel edge right across the brush. You can do it yourself by using the brush for about a day on a rough surface, such as a brick or cement wall. But if you do not wish to paint a wall of this kind, it is better to buy the brush already ground.

In a new brush the bristles are too long at first. A new brush should therefore be " bridled " or tied up with string to reduce the length. As the brush wears away, the bridling can be shortened. It is a mistake to bind the brush too tightly, so that a kind of waist is formed. A brush that has been dried and laid by should always be soaked in water for about an hour before it is used for painting.

With regard to the paint you use, you can mix it your-

self, or buy it ready mixed in tins. It saves a good deal of trouble to buy ready-mixed paints. But you should always get a good brand by a good maker, and when you buy it, open up the tin in the shop. If you find the body of the paint separated from the liquid, see if it will mix up properly. If it does not, it means the paint has deteriorated with age, and it should not be accepted. Should you be unable to find the exact tint you want, the oil and colour man will no doubt be able to help you to modify it by the addition of white or whatever colour may be necessary.

Apply the paint with straight strokes to and fro, using one side of the bristles in one direction, and the other side in the opposite direction. Always finish painting with the grain, not across it. Paint the smaller surfaces first, and finish with the larger ones. In a door, for instance, first paint the mouldings, and finish with the flat surfaces.

If you are completely redecorating a room, do all the dirty work first, and then proceed with the other work in the order of this section—viz., whitewashing, papering, and last of all painting.

French Polishing.

High-class french polishing, which gives a mirror-like appearance to woodwork, not only preserves it, but brings out the natural beauty of the grain. In this respect it is a finer method of decoration than painting, in which the natural beauty of the wood is hidden.

There are two kinds of french polish used, one called White Polish and one Brown Polish. Both consist of shellac dissolved in methylated spirit—about 6 ounces of the shellac to 1 pint of spirit. In the former kind you use all white or bleached shellac, and in the latter the ordinary orange or reddish-brown shellac.

A simple way of making up a small quantity is to half fill a bottle with broken shellac, and fill it up with spirit. The shellac dissolves gradually, and no heat is necessary. A little shaking up will assist the process.

The polish is applied by what is known as a french polisher's rubber. This consists of a piece of sheet wadding,

about 6 inches by 9 inches. The wadding is doubled over so that it becomes about 6 inches by $4\frac{1}{2}$ inches. This is then squeezed in the hand and pressed into the shape of half a pear. Care must be taken that the skin on the wadding is not broken.

The wadding is then covered with a piece of clean, soft rag. The rag is folded round the wadding in such a manner that it gives a smooth surface free from creases on one side, and forms a point at the end. This point is necessary to get the polish into corners.

To hold the rubber, place the forefinger over the point, press the thumb along the side, and grasp the surplus of rag in the palm of the hand.

To put the polish on the rubber, you open up the rag, drop a few drops on the wadding, and carefully replace the rag. Then press the rubber into the palm of the hand to distribute the polish throughout the wadding. It is very important not to get too much polish on the rubber; only a few drops at a time are necessary. A drop of raw linseed oil should be applied to the pad after it is charged with polish.

If a polished surface has been damaged and the underlying wood has been chipped or broken, it may be necessary to repair this with hard stopping. A very good stopping, called Beaumontage, can be made, which will fill up the damaged place and take a high polish afterwards. To make this stopping you require a tin canister or an iron pot. Put into the pot a teacupful of common orange shellac, a lump of resin about the size of a walnut, and about half this quantity of beeswax. If you are repairing mahogany, add a teaspoonful of venetian red; for walnut add dry brown umber, and for woods of lighter colour, such as oak, add yellow ochre. Then warm the mixture over a slow fire until it melts. Do not let it boil. Mix it up well with a stick, and pour a little out on a piece of smooth, flat board. As it cools, take it off with a stripping knife. Form it roughly into a roll in your hands, and while it is still warm roll it into a pencil-shaped stick between two boards.

To fill the hole, heat up a piece of flat iron, not letting it

get red-hot. Take this in one hand and the stopping in the other, and bring the stopping into contact with the heated end of the iron. The stopping will melt and can easily be run into the defective place. Fill it well up, with a little over, press it well in with the warm iron, and allow it to solidify. When it has hardened, the surplus can be cleaned off with a knife; then rub smooth with very fine glass-paper. It is well to rub two pieces of this paper together before using it on the stopping. This rubs off the sharpest cutting particles of glass, and it will give you a smoother surface on which to apply the polish.

A small piece of damaged veneer can be treated in the same way.

To apply the polish it is necessary to do the work in a warm room. A temperature of at least 70° F. is desirable. The essential feature is to get a good body of polish distributed evenly over the surface. It must be applied as quickly as possible, first with the grain, and then across it. The rubber must not be pushed to and fro like a scrubbing brush, but must advance in a kind of spiral track, each stroke overlapping the previous one. It should be applied with gentle pressure at first, but this can be increased as the polish is worked in and the rubber gradually becomes dry. Never let the rubber come to rest on the surface for a moment. It must be kept in constant movement while it is in contact with the wood. When it is dry, it must be recharged with polish, but always remember not to use it in excess.

This is called the "bodying-in process," and it must be continued until the wood will not absorb any more polish.

The work should then be left for a day, carefully covered to prevent dust from accumulating on it.

The bodying-in process should be repeated once or twice more, according to the texture of the wood. A hard, close grain will not absorb so much polish as open, coarse-grained wood, and does not require so many coats. Eventually a time arrives when the wood seems incapable of absorbing any more polish.

After each application the work may be gently smoothed

with the finest glass-paper. Do not rub hard, or the body will be rubbed off.

The final process is called "spiriting off." It is this which puts the gloss on the work. It is in reality washing the surface with methylated spirit. It consists of reducing the amount of polish, while the amount of spirit is increased.

First you recharge the rubber with three-quarters of the polish and a quarter of the spirit; then with a mixture of half of each; then with a quarter of polish and three-quarters of spirit; and finally with pure spirit. In the last process it is necessary to use a rubber which has not been used for polish. This rubber should have three or four coverings of rag, which should be removed one by one as they get dry. Great care must be taken to prevent too much spirit squeezing out of the rubber. If it does, you may find it is washing away the polish. All that is necessary is to dissolve the surface of the body very slightly, so that it settles down with an even, glossy surface. The rubbing should be applied evenly all over the surface. If the work turns out to be a failure, it is generally because too much spirit has been put on the rubber. If the work is being done correctly, the gloss will soon begin to appear. As the work nears completion, the circular motion should be stopped, and the rubber moved only in one direction along the grain. The final touching up should be given with the soft, dry rag only, without polish or spirit. The work should then be carefully covered to protect it from dust, and allowed to harden for a day or two before being used.

Convenient cases of french polishing sets can be bought at various stores, with instructions as to their use.

Relacquering Brass.

Brass fittings on furniture, finger-plates and handles on doors—in fact, nearly all brass work in a house—depend on lacquer to maintain a bright surface. When it begins to look untidy and dull, it means that the lacquer has worn off, for lacquer is merely a varnish laid on to keep the air from tarnishing the brass.

Relacquering is a simple matter. The fittings must first be taken down, put into strong hot soda water, and thoroughly scrubbed. If the metal has corroded, some of the oxide may not be moved by this process. In that case apply spirits of salt to the corroded parts, and when the stain has died out, put them back into the soda water and scrub them again; then carefully dry them with a cloth and put them into the oven.

When they are thoroughly heated, take them out and polish up brightly with a wash-leather. Do not use any metal polish or powder.

When they are nice and bright, put them back into the oven and heat them again.

They are now ready to receive the lacquer, which is to be bought ready for applying. It must be laid on with a soft brush and in one direction only, or bubbles will be formed and the coating of lacquer will not be even and clear. If you prefer to mix up your own lacquer, it should be prepared as follows: $\frac{1}{4}$ ounce each of anatta and saffron and 1 ounce of turmeric are dissolved in 1 pint of methylated spirit. This solution is then strained carefully through a linen rag. Into this put 3 ounces of seed lac, finely pulverized, and dissolve it over a low gas. (*This process requires great caution*, warmed methylated spirit being naturally very inflammable.)

The articles should then be taken out of the oven, and the solution brushed over them while they are still warm. They will dry quickly, and are then ready for refixing in their places.

"Cold" lacquer can also be bought, but the cleaning process must be carried out just as carefully as for hot, and the work must not be really cold when the lacquer is applied—in fact, the warmer it is the better the result will be. The hot process is best and most durable, but the cold is mentioned for use in cases where the article to be lacquered—*e.g.*, a bedstead or long curtain-pole—cannot be efficiently heated, or when the relacquering has to be done with the article in place—*e.g.*, a lock or hasp on a trunk.

CHAPTER VII

WINDOWS AND BLINDS

Window Panes: To Replace.

The first thing to do is to get out all the old putty and broken glass, leaving the "rabbet" in which the glass rests clean and even. A broken table-knife ground to an angle at the end so that it will get into the corners will do well enough; it is used in conjunction with a hammer, as old putty is very hard.

When you have your frame clean, you can measure the exact size of glass you want—it should not be a tight fit in the rabbet—and get it cut to size by the glazier, who will know how much putty you will want. Putty should be bought for each job as you want it, for though you can make dry putty usable by hammering and rolling between your hands, the game is not worth the candle.

When you have your materials ready, take a small lump of putty and roll it between your palms about ½ inch thick, and lay it into the rabbet all round, pressing it in with the ball of your thumb and as evenly as possible; then put in the glass and rub it along the four sides with a good even pressure; this will force out the superfluous putty and get a good bedding for the glass. You can then take putty on your putty knife, or any fairly flexible knife, or even a very small flat trowel, and work it into the rabbet to hold the glass in, smoothing it down evenly as you go along. It is usual to put a couple of small nails in to prevent the glass from falling out while you get the putty in, and these nails are covered by the putty and left in. When the putty has set, which will take time according to the weather, it should have two coats of paint to preserve it, as well as for appearance' sake.

Sash Cords.

The renewing of a sash cord is generally regarded as a repair that cannot be undertaken by the amateur. But in these days of expensive labour the cost of replacing a broken sash cord is so considerable that it is certainly worth knowing how to do it. It is really not a difficult thing to do, when you have acquired a knowledge of the construction of a sash window and frame.

It is obvious to all that the cords on either side of each sash are attached to weights somewhere inside the frame. The difficulty is to get at the weights. It is quite simple. The first thing to do is to take out the beading that is nailed up the sides of the window frame, and keeps the sash in position. To remove the bead, take an old chisel or screw-driver and hammer it into the joint between the bead and the frame. If you look carefully, this joint can easily be seen. Force the chisel in at various points along the joint, and lever the beading away. You will soon discover where the nails are, and these may draw through the bead and remain fast in the frame. If they do, leave them until the beading is out, and haul them out with your pincers. They may come out with the bead, in which case they will remain fixed in it, and should be cut off close to the wood, for it is impossible to get them driven into their old holes again without damaging the outer face of the bead. By working the chisel as a lever, you will soon be able to spring the bead right out. When this is done, you will find you can swing the lower sash out into the room. But if the broken cord is on this sash, you will have to rest it on the back of a chair, or on a table. packed up on a pile of books to keep it approximately vertical. It may be wise to get someone to steady it for you, in case it swings over and the glass gets broken. When this sash is safely out of the way, you must then remove what is called the parting bead. This is a flat strip of wood which keeps the two sashes apart and insures that they move up and down in their own grooves. To remove it, take hold of it firmly with a pair of pincers and boldly jerk it out.

You will find it is not fixed in very tightly. It is just pressed into a corresponding groove which runs from the top to the bottom inside the frame. When the parting bead is out, you will find a small panel (technically known as the "pocket piece") on each side of the frame near the bottom of the window opening. These panels can be removed by prising them up with a chisel and pulling them outwards at the same time. These small panels are sometimes hidden under the various coats of paint that have been put on from time to time. If this has happened, all you need do is to hammer smartly on the inside of the frame. The "pocket piece" will be found to give access to an enclosed space, in which the weights move up and down on either side of the frame.

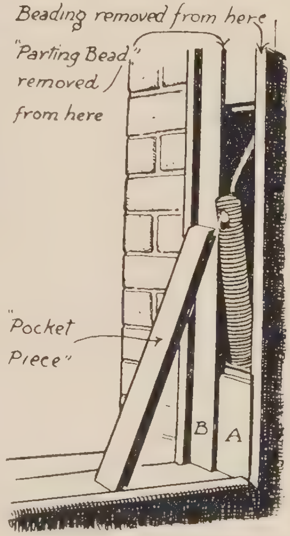

FIG. 20.—MENDING A SASH CORD.

A, Groove of lower sash; *B*, groove of upper sash.

Whichever cord is broken, the weight which it supported will be found resting at the bottom of the space. The weights are heavy—much heavier, in fact, than you would anticipate—so they must be handled carefully. A part of the broken sash cord will be found attached to the weight. You will find the cord has been threaded through a hole in the top of the weight, and kept from slipping back again by a knot. Take the piece of cord out, and note carefully how the knot is tied.

The next thing to do is to remove the other part of the broken cord, which you will find attached to the sash. You will find it is nailed into the sash in a groove which has been provided for it, or passed through a hole in the side of the sash and fastened by a knot. The latter is a superior

way, and does not injure the sash by driving nails into it. Preserve the nails if you can get them out without damaging them. They are special nails, like large tinned tacks. New ones can, however, be readily bought from any ironmonger, if you explain to him the purpose for which they are required, but ordinary "clouts" are more generally used. Everything is now ready for fixing the new line. The best kind is known as "cotton sash line." It is rather more expensive than ordinary hemp line, but it lasts so much longer that it is well worth the extra money. You can buy a "knot" of this, which consists of 12 yards, and is sufficient for several repairs. It is a good idea to stretch the whole length of the hank before cutting it, and to rub the line with common yellow soap before using it. It makes it more pliable. Having made all preliminary arrangements, the next thing is to thread the cord through the pulley fixed at the top of the window frame. The best way to do this is to have a piece of string about 6 yards long, with a small weight on the end. This weight has to be passed over the top of the pulley and lowered until it comes to the bottom of the enclosed space in which the weight moves up and down. As the opening above the pulley is rather small, the weight must also be small. A small piece of chain makes a useful weight for the purpose. You next tie the other end of the string to the end of the cord, and push the cord through the same opening as the string. Then, by taking hold of the string you can pull the end of the cord down until you can draw it through the opening disclosed by moving the pocket piece. This end is now fastened to the weight. It is pushed through the hole at the top of the weight, drawn out at the opening at the side, and then a knot is tied in it. When the knot is freshly made, you will find it difficult to push it back into the opening. The best way to do it is to knock it in with a hammer. When it is properly in, you will find the cord cannot be pulled out through the hole in the top of the weight. The weight must then be hauled up until it reaches the top of the enclosed space, and then you

drive a nail through the cord into the frame just below the pulley to fix the weight temporarily in this position.

The next step is to lower the sash you are repairing until it is right down, and when it is in this position you will be able to see, by looking at the groove on the side of the sash, where the cord must be cut off. The free end of the cord is then fastened into the groove by three of the tinned nails referred to above. It is rather difficult to get the nails through the cord. To make it easier, it is wise to hammer the cord flat. If you do not do this, you will find the cord tends to turn round as you are driving in the nails, so that you do not fix it securely through the centre. When hammered flat, it does not tend to turn round, and can be securely fastened to the sash. Having completed this, you can remove the single nail which was used to fix the weight in position, and then you will find the sash can be moved up and down in the ordinary way.

The next step is to replace the pocket piece, knock the parting bead back into position with a hammer, and then refix the bead inside. You will find this bead is what is called "mitred"* at the top and bottom. This mitre is to make it fit neatly to the corresponding beads at the top and bottom of the window frame. To get it into its proper position, you must spring it in. By "springing" is meant bending it like a bow used in archery. By bending it you shorten the distance between the ends, and it can then be easily pushed into position at the top and bottom; and then you straighten it out, and the ends are pushed right home and the mitred joint is formed. The beading is then fastened with one or two new nails (or brass screws, which are better, as you will find next time a cord breaks). The job is then complete, and you will have the satisfaction of knowing that you have done for about 2s. what would have cost you 10s. to 15s. if you had called in outside help.

When a cord breaks, it is nearly always through deterioration by wear or by exposure to weather. It is

* Mitred—*i.e.*, the end is cut at an angle of 45 degrees, to make, with another similarly cut, a right-angled corner.

therefore always wise to examine the other cords to see that they are not just about to give way, and you will presently have all the trouble of again dismantling the window frame, with its attendant damage to paint and possible breakage of beadings.

BLINDS

Spring Roller Blinds.

There are two kinds of spring blinds that are met with in houses.

One is an American patent, and is known as the Hartshorn Spring Roller. The great advantage about this is its low cost.

The other kind is known as the Spring Roller Blind. It is less likely to get out of order, and rather more substantially made than the former.

There are only two repairs that can be carried out without the expert's help. You can rewind the spring, which consists of a coiled wire; and if the blind does not draw up quite straight, you can correct it.

The first repair is wanted from time to time, as the spring weakens through use. It becomes evident because the blind will not roll right up to the top.

If it is a Hartshorn Roller, the repair is very simple. In all spring blinds the spring is wound up every time you pull the blind down. If the spring does not carry the blind right up, pull the blind down to its fullest extent. Remove the roller carefully so as to avoid releasing the spring, and when it is free from its supports, roll the blind round the roller by turning the latter carefully in your hands. The additional turns you give the blind when it is out of its brackets are all additional stored power that will come into operation when the blind is fixed again and put into use.

It would be well, while the blind is out, to put a drop of oil on the small lever that you will find at the end of the roller.

These blinds are supported on brackets, one of which has a round hole in which a round pin projecting from one end of the roller turns, and the other has a slot which holds the flattened extension at the other end, which is attached to the spring inside the roller, so that it cannot turn.

The other type of roller, one which has a trigger at the side, attached to a small lever for releasing the spring when you want to raise the blind, is recharged in a different way. The spring in these blinds is attached to a square spindle that projects about ½ inch at each end of the roller.

These square projections fit into square holes provided for them in the brackets. To recharge the spring, take the roller out of the brackets. You can easily do this by springing back one of them. They are made of thin steel, and will stand it without damage. A screw-driver will be found useful for the purpose. When the roller is clear, give the end to which the trigger is fixed, a turn or two in a counter-clockwise direction. The cord is fastened to the trigger, and you will have to clear it as you turn the end round. Before refixing the roller, see that the blind is completely rolled up. Care must be taken to get the blind in the correct position. On the square end that projects from the right-hand end a small notch will be found. When fixed, this notch must be upward.

It is not wise to overcharge the spring. Do just sufficient to take the blind well up to the top.

When the blinds are attached to the roller in the first instance, they are generally sewn to a piece of webbing which is wound round the metal spring. Should the blind not roll up quite straight, you cannot very well take it off and refix it. This is a blind-maker's job. The easiest way to deal with the difficulty is to slip a small piece of cardboard or wood under the webbing at the end where the blind wants raising. Only a thin slip is wanted. Its effect is to make the roller larger at one end than at the other, and this gets over the difficulty. If you put in too wide or too thick a piece, you will transfer the error, so that the end you have attended to will wind up first.

It is an easy matter to adjust this and make the blind roll up quite square.

If any other repair is necessary to a spring roller, it is better to send it to a blind-maker.

Venetian Blinds.

These are not very common nowadays, but there are still many houses fitted with them, so a hint or two concerning them may not be out of place.

The laths seldom get out of order, but the tapes and cords are more often the source of trouble. When one of the thin cross-tapes on which the laths rest breaks, it may be possible to repair the damage with a needle and thread; but if the perpendicular tape breaks, it is a sign that it should be renewed. To do this, take out the tacks on the under side of the bottom thick lath, the blind meanwhile hanging down, and cut off the knots on the ends of the cords and pull them right out, for it is pretty certain that you will need new cords as well as tapes.

You can then lift out the laths one by one, and they can be washed or painted or varnished, as you think necessary.

The old tapes are released by removing the tacks; but do not throw them away until you have measured your new ones.

Next take out the screws which hold the top board to the brackets (or to the top of the window frame, as the case may be), and take the board down.

The cords run over little grooved pulleys; if any of these are chipped or damaged, they can be removed by punching out the pin on which they revolve and putting in new pulleys, which are to be had at most ironmongers' at a small cost.

It is very common to find the slots in which the pulleys work worn away so that the pulley can wobble and the cord get down by the side of the pulley and stick in the slot. When this is the case, take a piece of tin somewhat longer than the slot and about an inch wide; double it over lengthwise, leaving the bend rather open, so that you have

not a sharp edge at the fold; lay it with the folded side against the side of the pulley, but not so close as to prevent the pulley from turning freely, and fasten it with two or three tacks or screws (an old bradawl filed to a point will make a hole for the tacks—you can use a hammer to send the bradawl through the tin); you will then have as good as a new slot, which will keep the pulley running true, and the cord will not want to jump off.

The new tapes should be of the "woven ladder" kind, as sewn cross-ladders invariably come undone—indeed, it is rare to see them nowadays. The tapes are fastened on with tacks, and these should not, if possible, go into the old holes. Rest your lath on something solid while you put in the tacks; there is no need to hammer them with great force.

It is just as well to fit new cords while you have the blinds taken to pieces, though if the old ones are quite sound and unfrayed they may be washed and reinstated; but make sure they are sound by tying one end to something solid and pulling hard; this will reveal any weak spot which may not be apparent to the eye. If the cord does not break when pulled, it is worth using again.

Venetian blinds are often fixed so that you cannot get at the top side of the thick upper lath which carries the pulleys, so in putting them back in place the cords should be threaded through first and left hanging down, the tapes being held perpendicular by the weight of the bottom thick lath. You can now proceed to insert the laths, beginning at the top, of course, and threading the cords through the oblong holes, taking care that the cross-tapes on which the laths rest come on left and right of the holes alternately, so that the cords hang straight down between the alternate cross-tapes. When all the laths are in, the cords are passed through the holes in the bottom lath and knotted securely, so that they cannot pull through, for remember that the knots have to support the weight of the whole blind, as well as any unnecessary pull given them by an energetic though injudicious person.

CHAPTER VIII

LIGHTING

Electric Lighting.

THERE are very few repairs to electric lighting systems which can be undertaken without expert help. It is wiser to confine our attention only to these simple matters. *But read the warnings carefully; the current used in electric lighting is powerful enough to hurt or "shock" you.*

Electric lamps which are used in house-lighting have become very expensive. The modern type metal filament lamp has superseded the old carbon filament lamp, which is very extravagant in the current it consumes. If held up to the light the very fine wire can just be seen. Should a lamp fail, it is always worth while to examine it carefully, for it often happens that one of the fine strands of wire composing the filament has broken. The two ends can be seen vibrating quite close to each other. It is sometimes possible to repair them. What you have to try to do is to bring the two ends into contact while the current is turned on to the lamp. The best thing to do is to fix the lamp in the holder of a single pendant, switch on the current, and try shaking the lamp slightly and tapping it on the part near the holder. The result of this often is that one of the two loose ends touches, and fuses together with, some other part of the filament, and the light shines out brightly once more. One does not always succeed, but it is worth a trial.

There is one other small matter which is worth attention. All lamps are very brilliant at first, but by degrees they grow dim. It is rather an annoying thing to know that as the light gets dim, the amount of current which passes

through the lamp increases. If then the lamp in question is in a room where a good light is required *frequently*, it is a very uneconomical thing to keep it there, not getting sufficient illuminating effect, and at the same time using more electric current than is necessary. In this case, if you have a point where the light is only wanted *occasionally*, it is quite a sensible thing to fix the dim lamp there instead of throwing it away. It may still do useful service in a china cupboard, a larder, or a box-room or other apartment of that nature.

When new lamps are required, it is well to take one of the old lamps with you to make certain that you get one of the correct voltage and "wattage," or candle-power. If the voltage of the lamp is lower than the voltage of the circuit, the lamp will promptly burn out directly the current is turned on. If the lamp voltage is too high, the current will fail to make the lamp burn brightly.

Another repair that can be safely undertaken is the replacing of a fuse on the fuse-board. The fuse is the weakest link in the circuit. It is intended to be the weakest link. It really acts in the same capacity as a safety-valve on a steam boiler. If the pressure of the current passing through the fuse rises to too high a point, the fuse suddenly melts or "blows," cutting off the current from the circuit which it protects.

These automatic "safety-valves" are usually arranged thus:

(*a*) The Company's fuse, a safety-valve between their main cable in the road and the meter of your house; it is generally sealed, and has nothing to do with you.

(*b*) The *main* fuse, between the meter and your lighting system, generally on the main cable near the meter, on the house side of it.

(*c*) *Circuit* fuses, as described below, each protecting a group of lamps.

Should the *main* fuse go, it must be regarded as indicating a serious defect in the installation. It will, of course, throw the whole house into darkness; but it is not wise to attempt to replace the "main" fuse, which requires the

attention of an expert, as there is great danger of a serious shock from the main current.

In wiring a house for electric lighting, it is usual to arrange the wires in several circuits, each carrying not more than six lamps. Each of these circuits has its protecting fuse. If a fuse "blows," the fact is at once known by the lamps on that circuit going out. If you

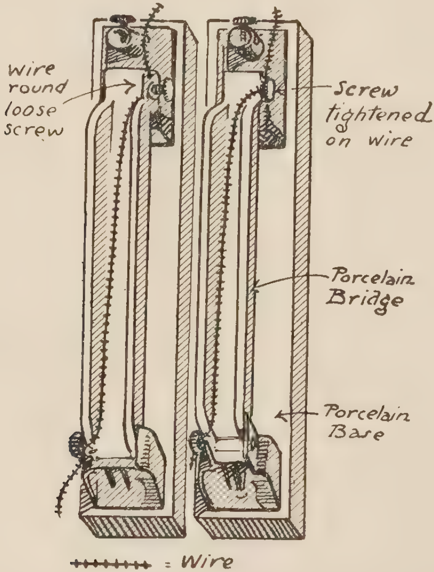

Fig. 21.—Fuse-Board, showing Two Porcelain Bridges.

examine the fuse-board carefully, you will see, by the blackening of one of the porcelain bridges, which one has gone.

The next step is to cut off the current at the main switch. If this is done at night, it plunges the whole house into darkness. For this reason, if it is convenient to postpone the repair until the next morning, it is wise to do so. It is *quite essential* to have the current off. You cannot put

in a fuse unless it is. You may get a very strong shock if you touch the terminal screws on the bridge while the current is on.

Having assured yourself that the current is off, you can loosen the screws of the two terminals, remove any remnant of the old fuse, and instal the new one. The porcelain bridges usually lift clear out from brass spring-clips, or at least are hinged at one end and spring-clipped at the other. Wind the fuse wire once round the screw thread, and turn the nut until it keeps the fuse from slipping out. Do not screw it up too tightly. This may tend to crush the soft fuse wire out of shape, and so reduce its sectional area and make a still weaker point in the already weakest link in the circuit. In modern practice the replacing of a fuse wire is much simplified, for the fuse-holders can be pulled out bodily, making the fixing of the new wire an easy matter, but the *method* of so doing is as described above. Having fixed the fuse, turn on the current at the main switch, and test the new fuse by lighting all the lamps on the circuit to which it has been connected.

The most important point about the operation is to use fuse wire of proper material as well as thickness. It is best to go to a local electrician and purchase a few feet of fuse wire *suitable to the voltage in your district.* It is very unsafe to use any but fuse wire of the correct material and gauge. There are several reasons why a fuse will "blow." The fuse itself may be damaged by being tightly squeezed by the nut. All the lamps that are supplied by the circuit may be suddenly turned on, and some of these may be getting dim, and so will allow too much current to pass through them. But the most serious condition may be that there is a fault in the circuit, and current is escaping to earth. If this is the case, the fuse will very probably go again almost at once. If it does, you must call in a dependable electrician, because it is through such faults in the wiring that fires are caused. Wiring for electric light is very different from wiring for bells. The pressure or "voltage" is high enough to cause a spark where there is any imperfection in insulation or points of

contact, which will quickly set fire to any inflammable material with which it comes in contact. And if through want of proper fuse wire you have been tempted to repair a fuse which has blown with a piece of thick iron or steel wire, such as a hairpin, the result may be that the fuse does not blow, and the leakage continues, growing possibly worse, which not only costs you money for a lot of current that has not given you any light at all, but has, in fact, subjected your house to the gravest risk of being burnt to the ground.

Occasionally the turning of a switch fails to produce a light in the lamp. If such a thing should happen, first cut off current at the main switch, screw off the cover of the faulty switch, and by moving the small projecting lever, or " handle," up and down slowly, make certain that the connecting copper surfaces actually come into contact. You will soon be able to see if the contact is made. If not, open the switch and bend the copper faces slightly until they engage properly when the switch is turned on.

Beyond these two or three small repairs it is not safe to go. The risk of an error is a grave one, on account of the dangerous consequences that may ensue. Indeed, there are so many possibilities of serious bodily hurt or material damage, that it is far wiser to have even the smallest defect put right by skilled hands.

Gas and Electric Meters.

How to Read a Gas Meter.—Every gas meter has a small glazed aperture, behind which is a row of dials, each with a pointer or hand on it. These dials form the index of the meter. The number of dials varies with the size and make of the meter. The smaller meters, which are found in moderate-sized dwelling-houses, usually have four dials. One of these is by itself above, and the three others are in a row below it.

The top dial is only employed to test the amount of gas used by any particular burner or gas ring in a given time. The pointer on this dial makes a revolution in the course

of a few minutes. Beside this dial is printed the number of cubic feet of gas consumed while the pointer makes one complete revolution. If, then, you note the time occupied by the pointer in making one complete revolution, you know how much gas has been used in that time.

Each of the other dials is marked round its circumference with all the figures 0 to 9. Each pointer travels round ten times as fast as the pointer immediately to its left. It will also be noticed that the pointers on alternate dials travel in opposite directions.

To read the amount of gas that has been used since all the pointers stood at 0, you must note carefully the position of each of the pointers, beginning with that at the right-hand end of the row. They must obviously be exactly on a figure or between two figures. If a pointer is exactly on a figure, that figure must be written down for that dial. But if it is between two figures, you must put down the lower figure. Let us take an example, and assume that the pointer on the right-hand dial is between 6 and 7; we put down 6 for that dial. The pointer on the next dial to the left is between 0 and 1, so we put down 0 for that, and the pointer on the next dial is between 4 and 5, so we put down 4 for that. We write these figures down in the same order as the dials are placed, and get the series 406, and because the right-hand dial registers in hundreds of feet and the succeeding ones in thousands, ten thousands, and hundred thousands of cubic feet, we must add two noughts to the figures we have in order to get the reading for the meter—*i.e.*, 40,600, which is the number of cubic feet of gas used since the pointers all stood at 0. If you examine the meter a month later, you will find the figures are different. You would probably get something like 41,700. By subtracting the smaller from the larger total, you would get 1,100 cubic feet as the consumption for the month.

Sometimes it is difficult to see if the pointer has actually passed a figure or not. You can find out by looking at the next dial on the right. If it is exactly on the figure, the next pointer will be at 0. If it has not quite reached the

figure, the next dial will be between 9 and 0. If it has passed the figure, the next dial will be between 0 and 1.

The Gas Company sends round an inspector to read the meter each quarter. He is required to enter on a card, which is kept by the householder, the meter reading. By subtracting from the last total entered on the card the total given at the previous visit, you get the number of cubic feet used during the quarter, and can so check the gas account when it is rendered.

As gas is now charged for, not by the thousand cubic feet, but by a new unit recently introduced, called a Therm, the checking of the gas account involves a further calculation.

The therm is the equivalent of 100,000 British Thermal Units; and the first thing to determine is the "declared calorific value" of the gas, which varies for each Company and from time to time. For instance, the declared value of the gas supplied by the larger London Gas Companies in October, 1922, was as follows:

South Metropolitan Gas Company ..	560	heat units per cubic foot.
Gas Light and Coke Company ..	500	
Commercial Gas Company	475	

1 Therm = 100,000 heat units.

The declared value is stated on the meter card supplied by each Company, and represents the quantity of *heat*, not of *light*, contained in each cubic foot of the gas.

Having ascertained the number of cubic feet consumed and their calorific value, you multiply the two figures together and divide by 100,000, and the result will give you the number of therms for which you have to pay. If the number stated on your bill does not agree, and you are satisfied that your calculations are correct, you should write to the chief office of the Company supplying you and ask for an explanation of the discrepancy.

The above directions are given on the meter card issued by the Gas Light and Coke Company, and no doubt by other Companies as well, and a table printed at the foot

of the meter card will save a good deal of trouble to those who do not consider themselves good at arithmetic!

Electric Meters.—The principle of an electric meter is exactly the same as of a gas meter. The usual type has a series of four dials, the one on the right being marked "1 unit per division," the second being marked "10 units per division," the third "100 units per division," and the fourth "1,000 units per division." To read this meter you put down the lower of the two figures between which the pointers are, but you do not add two noughts, as in the case of the gas meter for each division, for the right-hand dial is here registering "one" unit instead of one hundred cubic feet. The electric unit is also known by another name. It is sometimes called a Kilowatt-Hour. This name is sometimes used on the meters, but it means exactly the same as the word "unit."

How to Cure a Gas Tap which Sticks.—Some gas taps develop the annoying habit of sticking. They gradually lose the smoothness with which a new tap can be turned.

When this occurs, turn off the gas at the main, take a small screw-driver and undo the screw which will be found at the bottom of the tap under the tee handle. When this screw is removed, care must be taken not to overlook a small metal washer which will be found under the head of the screw. This washer generally sticks to the tap when the screw is withdrawn. If it does, it can be easily removed, and should be set aside carefully with the screw.

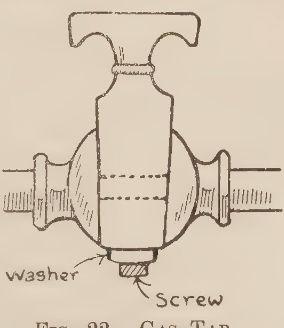

FIG. 22.—GAS TAP.

When the screw and the washer have been removed, give a sharp tap with the *wooden handle* of the screw-driver on the end of the plug from which the screw has been withdrawn. This will loosen the plug to which the tee handle is attached, and it can then be withdrawn.

It will reveal a round tapered hole right through the gas tap.

A small piece of clean linen, which can be passed easily through this hole, is wanted. Put a little emery powder or knife powder on this, and rub briskly inside the hole. In the same way, clean the surface of the plug and the hole through it. All emery dust or knife powder must be wiped carefully off, and a little smear of tallow rubbed over the plug, but not enough to block up the gas passage.

Then replace the plug, put on the washer and screw—the washer will only go on in one position, as it has a "flat" on it to prevent it from turning when the plug is revolved—and tighten the screw sufficiently to prevent an escape of gas. This can be ascertained by turning on the main cock again.

If the plug and the inside of the tap in which it is housed have been thoroughly cleaned, the tap will be found to work quite smoothly again.

Acetylene Gas.

This form of lighting, so convenient in isolated districts where no electric mains or gas mains are available, has been used for more than twenty years.

The best forms of generating plant insure that gas is only made when it is required, and then only in proportion to the demand.

If any householder decides to instal a plant, he should insist on this as its most important feature.

The running cost per candle-power hour is low. There is practically no wear and no renewing of parts. Burners last for many years, and do not require renewing like incandescent gas mantles and electric lamps.

The only operation that is essential is recharging with carbide and renewing the purifying material in the purifier.

Too much attention cannot be paid to the purifier. It is essential if the one disadvantage of acetylene gas is to be avoided. Without it there is an unpleasant

smell from the burnt gas. This part of the apparatus should receive the care and supervision it demands.

There is also a tendency for minute particles of dust to lodge in the opening of the burners. These, then, need to be cleaned with fine wire or a needle occasionally.

Globes and shades should also be kept perfectly clean. The full advantage of the light cannot be obtained if they are dirty.

Do not be tempted to buy any but the best carbide of calcium. Do not be satisfied with any that is not guaranteed to yield 4·8 cubic feet of gas per pound of carbide. This is the best quality, and it is the cheapest in the end.

Finally, arrange with the firm that instals the apparatus to overhaul it once a year. It is good policy. Ask for a quotation for this service when you get a quotation for the apparatus.

CHAPTER IX

ELECTRIC BELLS

THE installing of electric bells is not a difficult matter, and it can be undertaken by anyone with a reasonable assurance of success. But as the object of this book is to show how "repairs" can be carried out without calling in professional help, we will deal with that side of the question first. In doing this we shall learn sufficient to enable us to fix new bells, if we should ever wish to do so.

No one need be "afraid" of electric bells; the amount of current used is not enough to incommode a fly.

The electric bell is a very ingenious little piece of apparatus. It consists of three principal parts—a gong, a hammer, and a magnet. The magnet is not one of the kind we used to play with as children, but is what is known as an Electro-Magnet. This is a magnet in which there are two "cores" of soft iron, surrounded by coils of insulated wire. When an electric current is passed through these coils, the soft iron cores become magnetized. The poles of the magnet are the ends of the two pieces of iron.

Just opposite these two poles is a strip of soft iron called an armature. This is held in position by a small spring, which keeps it just clear of the poles. Directly the current is passed into the magnet, the armature flies into contact with the poles. Directly it touches the poles, it cuts off the current through the coils surrounding the cores, and these immediately become demagnetized, and the spring draws the armature away, permitting the current to flow again, and a repetition of this little series of operations results in the armature oscillating rapidly to and fro.

The armature is extended in the form of a thin metal rod with a knob on the end. The gong is fixed in such a position that the knob or hammer strikes it when the armature is drawn to the poles of the magnet.

The electric current in a system of electric bells is supplied by a battery of one or more cells. The type in general use for this purpose is called the Leclanché cell. They are made in two kinds, which are called respectively dry cells and wet cells.

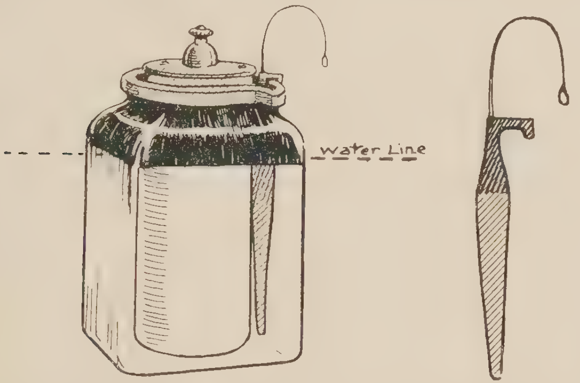

FIG. 23.—LECLANCHÉ CELL (*Wet*) AND SPECIAL ZINC.

There has been a tendency of recent years to use dry cells. They are very convenient because they require no attention. They supply the current for a considerable time, but eventually they become exhausted, and must be thrown away and replaced by new ones.

In buying new dry cells it is very important to get good ones—if possible, from the actual manufacturers. Firms like the General Electric Company, Ltd., and Siemens Bros. and Company, Ltd., make very reliable ones. The chief disadvantage in dry cells is that if they are kept in stock for a long time they gradually lose their current, even though not in use. It is quite possible that you may get cells that have already lost half their store of power. This you cannot tell, for there is nothing to show their

condition except perhaps a date, but if you can get them direct from the makers, you can usually depend on getting cells of full power. If you succeed in doing this, they form an economical and dependable source of current. If you cannot get the cells direct, then go to a large shop or store where the stock is sure to be renewed more frequently than in a small shop or so-called "electrician's."

The wet Leclanché cell lasts much longer, but it requires periodical attention. It consists of a glass jar, a porous pot, and a zinc rod. The porous pot contains a carbon plate, surrounded by powdered manganese. A terminal screw is attached to the carbon plate. The glass jar must be filled with a solution of sal-ammoniac before the cell will generate any current. When in general use, the water in the solution evaporates gradually, and for a considerable time—a year or so—all that is necessary to do is to add a little water to keep the jar filled up to the point where the black paint begins. But after a time the ringing of the bell becomes fainter, and eventually ceases altogether. Then it is necessary to recharge the cells.

For this purpose the cells should be disconnected from the bell wires and from each other, and emptied and thoroughly cleaned out. If what is known as "creeping" of the salts has occurred, the deposit should be carefully cleaned off. "Creeping" will be recognized easily in the form of a coating of salt which has appeared at the top of the glass jar and porous pot and zinc, perhaps overflowing.

The nut on the terminal screw on the top of the porous pot should be taken off and the whole thoroughly cleaned; the zinc and its looped wire connection should also be scraped clean.

The sal-ammoniac solution should be made some time before it is actually required, in order to allow the impurities in the sal-ammoniac to settle.

The cells are usually made in three sizes, and as a rough guide for making the solution the proportions of sal-ammoniac and water required are shown opposite each:

No. 1. Three-pint cells, about 6 ounces sal-ammoniac.
No. 2. Two-pint cells, about 4 ounces sal-ammoniac.
No. 3. One-pint cells, about 2 ounces sal-ammoniac.

When the salt is put in, thoroughly stir up the solution until all the salt has dissolved. There will probably be a certain amount of impurity, but this will gradually sink to the bottom and may be left there.

In filling the cells, the greatest care must be taken that no solution is spilled on the top of the carbon electrode or terminal screw of the porous pot, nor on the edge of the glass jar. It is this which sets up the "creeping" referred to. It is very important, too, not to fill the jars above the bottom of the painted portion. As an extra safeguard against "creeping," it is a good thing to rub a little vaseline, oil, or any grease over the black part of the porous pot and zinc, and especially on the top edge of the glass jar.

The ordinary zinc is a cylindrical rod with a copper wire sticking out of it. The zinc is gradually consumed in supplying the electric current. It is sometimes found that this consumption takes place more quickly at the point where the zinc leaves the solution than at any other part. Sometimes the rod is eaten completely through at this point, and a considerable part of the zinc falls to the bottom of the pot and is wasted. To avoid this, Messrs. Siemens Bros. have produced a special improved zinc, as shown in Fig. 23. The form in which it is made compensates for irregular consumption, and the whole of the metal is consumed usefully. In this type of zinc, mercury is incorporated throughout the metal instead of only on the surface, as in the usual cylindrical form. These improved zincs are not liable to incrustation, and are free from what is known as "local action," which causes the metal to disintegrate slowly when no current is being given out by the cell.

Sometimes it is found that newly charged cells of the fluid type, and also new cells of the dry type, run down very quickly. This indicates that there is a leakage of current from the wires. This is known technically as an

"earth." What it means is that at some part of the wires the insulation has given out and the current is constantly escaping. The insulation on the bell wires is usually only cotton thread soaked in paraffin wax and wound closely round the wire. If the wires come into contact with any dampness, corrosion is set up, which may result in the destruction of the insulation and the breaking of the wire.

It also happens sometimes that staples securing the wires have been driven in too far and touch the wires, so that a metallic contact is made between them through destruction of the insulation, resulting in an "earth" or a short circuit.

It will be readily recognized that when a leakage occurs on account of any of the above faults, there is a constant outflow of current until the battery has run down. Naturally, this does not take very long. In a good system of bells, when the insulation is quite sound, current is only being used when the bell is actually ringing. Under these conditions the life of the battery is a long and useful one.

Current should only be passing so long as the bell "push" is pressed. The "push" is a simple contrivance, which may be fixed at any point from where it is desired to ring the bell. It contains two terminals, to which the two bell wires are connected, one to each terminal. One terminal is connected to a small brass plate, and the other to a spiral brass spring. When the push is pressed home, contact is made between the spring and the plate, thus completing the metallic circuit along which the current flows. At the actual point of contact there is a small spot of platinum on both the spring and the plate. In the cheap kinds which are sometimes sold the platinum points are omitted, and such pushes should be avoided.

The bells will not ring unless everything, battery, bell, push, and especially the connections, is in order. The first thing to do when a bell does not answer to the push is to examine the battery, and see if the cells require recharging. To test the battery, the best thing to do is to connect the

bell direct to the battery, either by detaching the bell from the wires and holding the terminals against those on the battery, or by using two short lengths of spare wire to make a direct connection, when, if the battery is all right, the bell will ring immediately. This will inform you that the battery and the bell are both in good condition, and that the fault is in the wires or bell push. A careful

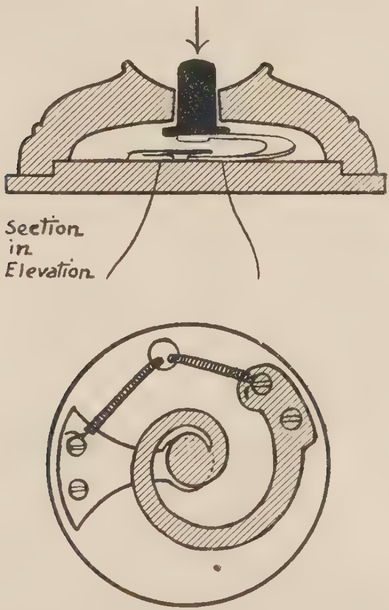

FIG. 24.—DETAILS OF BELL PUSH.

examination of the wires may reveal a broken wire or damaged insulation, brought about by dampness and corrosion, or through staples being driven in too tight. If at any point the wires have been carried under floor boards, it may be there that the damage has occurred. It is also quite a common practice to carry wires under the plaster on the walls or behind the skirting boards.

In these cases an examination of the wires may be so costly, on account of the damage that it entails, that the best and wisest step is to put in an entirely new system of wires.

The principles of wiring are shown on the accompanying diagram, and by carefully studying it it is not difficult to decide how the wires should be fixed. By fixing them along skirtings and, when it is necessary to pass doorways,

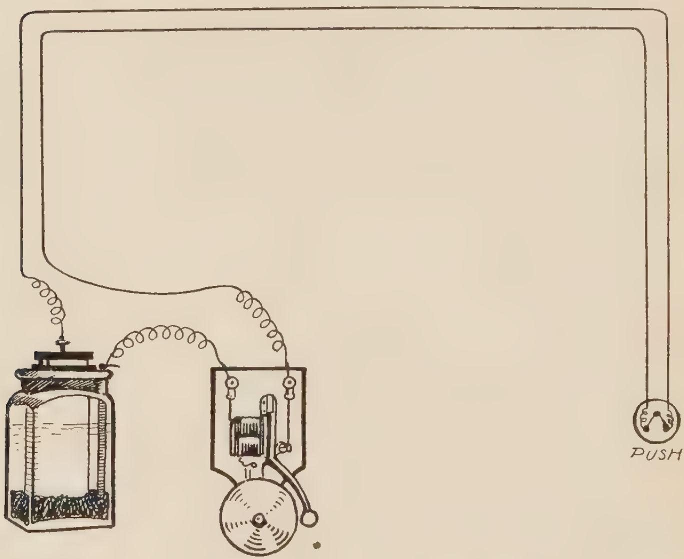

FIG. 25.—WIRING OF ELECTRIC BELL.

by carrying them over the top of the doors, where they can be more or less hidden by the wooden mouldings of the door frame, the new wires are always open to inspection.

The final advice, and the very best that can be given to anyone who is going to instal new bells or replace any defective part of an existing system, is to buy only the very best material that can be obtained. The initial cost may be more, but it has been proved over and over again

that the best is the cheapest in the end, and that "cheap" electric material is never satisfactory. Staples should be fixed about every 2 feet, and it is a good plan to wrap the wires at these points in adhesive tape, or to use special staples on which a strip of "fibre" is threaded. These may be bought from any dealer in electrical goods, and protect the insulation from damage by the staples.

If it is necessary to make a joint, remove about 2 inches of the insulation from the two wires to be joined; scrape the wires and clean them with No. 1 emery cloth until they are bright; twist them firmly together, and if you can use a copper bit, make a perfect metallic contact with a little solder.* Complete the job by binding it first with rubber tape well beyond the joint on each side, and finish off with black adhesive tape. Keep all the contacts bright and clean, and watch for and clean off any signs of the green verdigris which appears where corrosion starts.

* In soldering electrical work or gas meters and gas fittings, the use of acid is not permitted, as it causes corrosion of the brass or copper. A non-acid flux must be employed, such as resin or the prepared paste called "Fluxite." Solder is also to be had in the form of a hollow stick or wire having a core of non-acid flux. "Tinol" paste solder is the same thing in another form and is very convenient for fine work, as a small drop of it can be applied where required and heated with a (wooden) match until it melts and flows. Resin, "Fluxite," and "Tinol" check corrosion.

CHAPTER X

LINOLEUM

The laying of linoleum entails labour, and is therefore rather costly. It is hard and tiring work, but if you can put up with that it is not really difficult. The tools required are, *first*, something thick and soft to kneel on, for it is very hard on the knees! Second, a proper linoleum or floorcloth knife, costing about 1s. 8d. or 2s. You will also want a straight-edge to use in conjunction with a carpenter's pencil to give you a true line to cut by, —if the straight-edge is graduated, so much the better: it should be at least 4 feet long, and 6 feet is better; a 2-foot rule to measure with, a light hammer, and enough "sharp points," which are like brads with sharp points and no heads. They hold the linoleum down by their wedge-like shape, and are invisible when driven in flush with the surface.

Begin by pulling out or driving in flush with the floor any old nails or tacks. Do this carefully, for a single one overlooked will spoil your new linoleum when it is walked upon where anything hard and uneven is underneath. Then sweep the floor thoroughly.

In estimating the quantity you will need, measure the floor across in each direction and multiply the two lengths (in feet and fractions of feet) together. This gives you the number of square feet, and, dividing by 9, gives the number of square yards you must buy. For example, suppose the floor is 12 feet 9 inches by 10 feet 6 inches; multiply $12\frac{3}{4}$ by $10\frac{1}{2}$; that gives very nearly 134 square feet, which, divided by 9, gives very nearly 15 square yards.

It is wiser to choose a small pattern, for that is more economical, as little is wasted in making the pattern join

up; but if you prefer a large pattern you must allow about a tenth more for matching. If a plain stuff is chosen, of course, no such allowance is required.

Always cover the whole floor; sometimes linoleum is laid round a large wardrobe or other piece of furniture, or not under a bed, but this is unwise, as you can never tell when you will want to move the furniture, and you cannot because of the bare places that will be left!

Having got your material, give yourself plenty of room to work in by moving out all the furniture you can get rid of while you are working. If this is impossible, crowd it all together at one side of the room—you must get at least an 8 or 9 foot strip clear right down the room—then unroll the material with the pattern side, or right side, on top, and mark off a length; then turn the stuff so that your cut will come along one floorboard, not across them, or you will never get a clean cut through. Mark a clear line with pencil, and see that your knife is sharp. Kneel well over the work, so that your eyes come one on each side of the blade. This will insure a square cut. Draw the knife along steadily, keeping your eyes on the line, and the knife will run true along it. Do not press too hard, but draw the knife the full stretch of your arm and then take a second or third cut, until you know you are through, and go on to the next cut. Now lay the cut piece where it is to go, and see where you must cut out small pieces here and there to fit round doorways, etc. Tack this first piece down lightly at each end, but not along the side. Then cut another length and lay it alongside the first. If their edges do not meet, you can push the second just under the free edge of the first, and cut carefully, with the edge of the first piece as a guide which will insure a good joint. That is all there is to do—just measure carefully, mark where to cut with pencil, and cut gradually. When all is fitted, let it lie for a few days to settle down, when you may find a little more fitting necessary here or there, and then fasten down with sharp points about 6 inches apart, close to the edges of the adjoining lengths.

Before marking out your lengths after the first one, see

that you get the pattern to match by moving the succeeding lengths until the cross or diagonal lines run straight. You will have to sacrifice a little according to the size of the pattern, but an unmatched floor is a perpetual eyesore. If you can afford the room, get two lengths laid first, and move all the furniture on to them, so as to have comfortable room to finish your work in. Take care that no cuttings or loose tacks get underneath the linoleum, or they will spoil the job.

Further hints may be abbreviated thus:

The flatter and more evenly linoleum lies, the better it will wear. One often sees the lines of the floorboards showing through linoleum, either because the planks have warped (in which case you may plane them down, if you think the effort worth while), or because they have shrunk and left gaps between them (in which case, as a rule, you must "lump" it!).

Another great desideratum is accuracy of fitting, not only straight edge to straight edge across the floor, but particularly against the wainscot or other fixtures, round a door-jamb-beading, or across a threshold. If in such fitting you cut away too much of the linoleum, you leave a gap in which unhygienic matter accumulates; if you do not cut away enough, the linoleum will not lie flat, for all your glue and tacks. There is not much trouble in adjusting long straight edges to straight lengths of wainscot; but many floors and their surroundings call for more tricky work. In such cases it is frequently useful to make a pattern of the difficult part; if you are replacing old linoleum with new, the old piece can be used as the pattern, and the new piece cut from it; if there is no old linoleum, you can make a pattern with newspapers, by laying them down against the difficult edges and cutting with knife or scissors till you get an accurate fit—then use the newspaper outline as pattern.

It is a good rule never to throw away a piece of linoleum (*a*) unless it is too small to be of service anywhere; (*b*) unless the material is perished. As regards (*a*), oddments of linoleum are frequently useful for a variety of

purposes, in house and garden, as being both waterproof and easily cleaned; you can roof a hen-coop or rabbit-hutch or bee-hive; you can line the draining-board by the scullery sink;* you can cover a shelf, or sill, or seat, or box, in the bathroom; from the smaller pieces you can cut table-mats, and so on. A use for larger pieces has been suggested on p. 70 as floor-protectors when decorating. As regards (*b*), when the cork-composition perishes, or dries and cracks off from the backing, linoleum is still useful as an excellent fire-lighter; for which purpose *all* scraps may be saved.

* It is a good plan to cut a piece of linoleum for this purpose about an inch larger in each direction than the draining-board, and *bend up* (*without cutting*) the edges against the rims of the board except, of course, the lowest edge of the slope, where the water drains into the sink.

CHAPTER XI

MISCELLANEOUS FITTINGS AND REPAIRS

Airing Line for Clothes.

In flats and houses where there is no garden, a line on which freshly washed material can be dried, and the clean things from the laundry aired, can be fixed in the kitchen. The outfit consists of one upright pulley, a screw eye and "cleat," a length of fine sash cord or strong blind cord, and three pieces of wood about 4 inches by 2 inches by $\frac{3}{4}$ inch thick, to form a fixing for the pulleys and cleat.

The screw eye and the pulley should be fixed on opposite walls of the kitchen about 1 foot below the level of the ceiling, so that the line will stretch parallel to the wall in which the cooking range is fixed. When in position, anything hanging from the line should be just clear of the cooking range, and not immediately over it. Where there is the usual type of brick-set kitchener, the line should pass at least a foot away from the chimney breast. If there is what is called an independent cooking range, or a gas stove, each of which projects further into the room than the brick-set range, the line should be fixed correspondingly far from the chimney breast.

The third piece of wood is fixed on the wall immediately below the one carrying the pulley, and at a height which can be reached easily from the floor. Fix the cleat to this piece of wood and the pulley to the piece above it.

The screw eye, which is just a screw with a round loop formed at the end, is fixed into the piece of wood on the wall opposite the pulley. The cord is tied to the screw eye, passes over the pulley, and is fastened below by being wound round the cleat. By this arrangement the

line can be lowered for hanging the things on, and then pulled up into position. The clothes dry very quickly in the warm current of air that rises up from the range. If more than one line is required, a slight modification of this arrangement, involving the use of two cross-pieces of strong wood, one at each end of the line, when it is pulled up into position, will easily provide for this.

It is no good trying to nail the wooden supports directly to the wall. The weight of wet linen or flannels will soon draw out the nails; so the wall must be plugged, and the pieces of wood screwed to the plugs. The screws should be about $2\frac{1}{2}$ inches or 3 inches long, and of the size known as No. 9 or No. 10. Two plugs will be necessary for each piece of wood (see "Plugging a Wall," p. 126).

An airing frame, consisting of three or four wooden laths or rods supported on a pair of hangers, is a useful contrivance. This also is raised and lowered by a pair of pulleys. The whole outfit may be obtained, ready for fixing, for a few shillings.

The Bedroom Looking-Glass.

The looking-glass in general use in bedrooms is attached to the dressing-table. It is fixed in such a manner that it can be tilted at any desired angle to suit the convenience of the user. If you examine such a glass closely, you will see the glass is supported on two small steel ball-ended pivots which project from the uprights which hold the glass. The ball ends of these projections fit into two brass catches on the frame. The catches are hinged at the top, and can be opened and closed for putting the glass in position. The two small parts of the catch, which are hinged at the top, are drawn together by a screw so that they grip the ball-shaped ends of the pivots. The screws have butterfly heads for turning them round between your finger and thumb. It is by tightening up these screws that the necessary pressure is exerted on the steel projections by which the glass is held in the desired position. The arrangement is very convenient, but it has one great

drawback. By constant movement to and fro the softer metal of the brass catch gradually wears away, and one day you find the glass will not remain at the angle you require it. Sometimes you can tighten up the screws a bit and get over the difficulty, but sooner or later the same thing occurs again. The best thing to do is to remove the screws and brush them with an old toothbrush and paraffin until they are quite clean, and wipe them dry with a rag. Remember that when you take out the screws, the catches will fly open and let the glass fall, so when you remove the screws, take the glass out as well.

When the screws are thoroughly cleaned, you may find that when they are replaced the necessary pressure can be exerted on the steel supports. The important point to remember in cleaning is to avoid scraping the screws with a knife or anything likely to damage the thread. Sometimes it will be found that, in spite of having thoroughly cleaned the screws, it is impossible to tighten the catches sufficiently to hold the glass firmly. This indicates that the wear has gone on too long, and that the catch has reached the end of its useful life and is not worth keeping. But even in this case by wrapping some soft wash-leather round the ball-shaped end of the steel projections, the life of the catch can be prolonged for a considerable time. If the screw is hard to turn, it may be necessary to use a spanner or the flat-jawed pliers, but this must be done quite gently, as the head of the screw can be twisted off with astonishing ease when a heavy spanner is used.

Chairs, Sofas, etc.: To Reweb.

The webbing of chairs is subjected to very severe strains, and sooner or later is sure to need renewal.

Some chairs are provided with springs on which the hair or wool padding rests; in others the padding rests on a piece of canvas or hessian, which in turn lies directly on the webbing. The seats are sometimes fastened to the framework of the chair with tacks, and in other cases they are separate and can be lifted off the chairs.

We will deal with the spring-seated chairs first.

To do this the chair should be turned upside down, and the seat should be placed on the seat of another chair, or on a box, to keep it level. It is also advisable to put down a dust-sheet on which the chair may rest. This will protect it from damage against the floor.

All old tacks should be taken out of the wood framework of the seat with a cold chisel—*i.e.*, one made entirely of steel—and a hammer. A still better implement for the purpose is a steel claw, which is curved so that the tacks can be levered out.

When the webbing is removed, the springs are easily accessible. It should be noted how they are stitched to the canvas, which is now below them, as the seat is upside down. This piece of canvas is called the spring canvas, and each spring should be stitched to it in three places round the top coil. If the springs have become detached, it gives a good opportunity of thoroughly brushing the dust out of the canvas before you sew them on again.

Sewing the springs to the spring canvas can be done most easily with a bent packing-needle and good twine; common string will wear through and break very quickly. When the sewing has been completed, we are ready to fix the new webbing.

It is best to buy good, stout English web, and $\frac{1}{2}$-inch or $\frac{5}{8}$-inch tacks. It is often wise to put one more length of webbing across each way than there was originally. This adds to the strength, and, if the webs are equally spaced, it saves putting the tacks into the old holes.

Cut a length of webbing, allowing about 1 inch for turning in at each end. First fix one end with a single tack in the middle of the web, but be careful that the hammering in does not break the wood frame, which it may easily do in a small chair. The frame should be strongly supported from below at the point where you are hammering. Two more tacks should then be driven, close to the edges, through the two thicknesses of the webbing when turned in. When one end has been fastened, the other end should be gripped with the pincers in such a

way that when the rounded jaw is rolled back over the wood frame by lowering the handle, it stretches the webbing very tightly. The first tack should then be driven in at this end. This tack can, of course, only be fastened through one thickness of the web, but it will serve to keep it stretched temporarily, so that the pincers can be released. The spare end of web is then folded over, and the two other tacks are driven through the double thickness.

Proceed in the same manner with the other lengths of webbing, threading them over and under each alternate web in the usual way.

While the webbing is being tacked on, the springs may make their presence felt by behaving in a very unmanageable manner. They may even thrust themselves between the webs. You can usually work them back into position, but if they are very strong and troublesome, it is a good plan to reduce their range of action temporarily by tying the coils together to keep the spring compressed. These tyings must be cut off later with a sharp knife or a pair of scissors.

When all the webs are in position, the springs should be sewn to them just as they were to the canvas; make sure you sew them vertically, so that they are pushed straight together when the chair is sat upon, and not sideways.

It makes a good finish to the job to cover the webbing with canvas or black linen. Stretch this as tightly as possible, and tack it down closely all round.

In a spring-seated chair the webbing is nailed on to the under side of the framework, whereas in a padded seat without springs the webbing is fastened on top of the framework.

When dealing with a padded seat, whether fixed or loose, you begin by taking off any gimp, braid, or fringe there may be, and then you remove the outer covering, using care not to cut it with the tool you use for removing the tacks. Under the outer cover there is canvas, which comes off next, exposing the stuffing. If the stuffing is in pretty good condition, remove it in one mass; but if it is much matted together, it should be torn apart and the dust

shaken out. You can then remove the canvas covering the webs, and finally the webs themselves. The new webs are put on in the same way as in the case of the spring seat, though, of course, on top of the framework. Do not be tempted to renew one web only, for the breaking of one is a sure sign that the others will soon give way, when you will have all your work to do over again.

When new webs and, if necessary, new canvas are in place, spread the padding evenly over, seeing that it comes thickly over the front edge of the chair. Lay the upper canvas on it, and tack down the front edge and two sides. The stuffing can then be adjusted with a cane or stick until you get it spread evenly, when you nail the back edge down. The finishing touches are given with a bradawl ground to a round tapered point, which you prick through the canvas and lever the padding into the place where you want it. (You may have to add a little stuffing.) Then replace the top cover and gimp.

Clocks: To Restart.

When a clock of the ordinary bracket variety stops, make sure, by trying the effect of a gentle wind-up, that it has not merely run down. If it goes for an hour or so and stops again, it probably needs taking to pieces and cleaning—a job that few amateurs are capable of carrying out successfully. But the following temporary expedient may be tried:

Take a small piece of cotton-wool, drop paraffin on to it till it is moistened but not soaked, and put it inside the clock-case out of the way of the pendulum. Start the clock, shut up the case, and leave the wool inside for a day or two.

The clock will probably soon go normally, as the paraffin, vaporizing, liquefies the thickened oil that is clogging the works. But if after going for a few days it stops again, put in freshly charged wool and leave it longer than before. Repeated failure would indicate that a thorough cleaning and re-oiling, or some other attention at the hands of an expert, is required.

On the other hand, this method will frequently be found to insure good going for months or even a year or so; but obviously no piece of machinery ought to be worked too long without proper oiling.

N.B.—Paraffin is a cleansing agent—a solvent of heavier oils, *not* a lubricant.

Before sending the clock away, however, it may be worth the more enterprising amateur's while to try the application of a little *typewriter oil* to all frictional points with a camel's hair brush. The slightest touch with the point of the brush, held with a steady hand, is all that should be given.

The original trouble, however, especially in winter, may have been that the oil has become sticky through extreme cold: and a few moments' exposure to the heat of the fireplace will set the movement free.

A clock, by the way, is better *not* kept on the mantelpiece. There is always more dust there than in any other part of the room.

Door Handles.

The kind of handle we are referring to is that most commonly found in houses. It is the ordinary knob used with mortice locks and rim locks.

As the names indicate, the mortice lock is let into the edge of the door, while the rim lock is screwed on to the face.

A square spindle passes through the door and through a square hole in the lock.

Sometimes the spindle has a handle permanently fixed to one end of it, and sometimes both handles are loose. The fixed handle is generally fastened to the door by means of three or four small screws through the "rose," or plate. Should this come loose, it is a simple matter to refix it. The position of the part of the handle which is screwed to the door does not matter, so that it is best not to refix it in its original position, but to turn it round so that the holes drilled through it for the screws are opposite wood

which has not had screws in it before, and you must make fresh holes in the wood with the bradawl.

The loose handles are fastened to the spindle by a screw which has no head, called a "grub screw." You will find a series of small holes at each end of the spindle. These are intended to allow for doors of different thickness. Through what may be called the waist of the handle is a small hole with a screw thread in it, into which the grub screw is driven, its pointed end entering one of the holes in the spindle. If the screw is lost, a new one can easily be obtained from the ironmonger if you take the loose handle with you, for the screws are not always the same size. When fixing the handle, it is advisable to see that the screw hole is at the top, as well as the holes in the spindle, so that the screws are screwed downwards, for in this position they are much less liable to work out and be lost.

Door Locks.

Door locks are made in a multitude of patterns, far too many to describe in detail. They all have the bad habit of getting out of order.

The usual fault is the breaking of the spring. Every door lock has a spring which keeps the latch thrust out. You know at once when the spring breaks, because the latch or bolt does not come out and the lock does not keep the door closed.

To repair it the lock must be taken off.

The first step is to take off one handle and withdraw the spindle. If it is a rim lock, you can easily see the screws which fasten it to the door, and on taking these out the lock will come away. If it is a mortice lock, you will find a brass plate with two small, very short screws in it on the edge of the door. On removing this, an iron plate which is part of the lock itself will be revealed, with two screws through it which secure it to the door. Withdraw these screws, and then with the help of your screw-driver you can prise the lock out of the mortice in the door.

The working parts of both kinds of lock are got at by

removing the plate which covers one side of it, held in place generally by a single screw, though sometimes two are used. In some old locks the side plate is held in place by riveting over projections in the surrounding edge of the "box." When the plate is taken off, it is wise to examine the lock very carefully, keeping it horizontal so that nothing falls out of position. You will probably be able to see the kind of spring used, and the position it occupied. If the spring in breaking has moved, it is often rather difficult to decide how to fix it. Under these

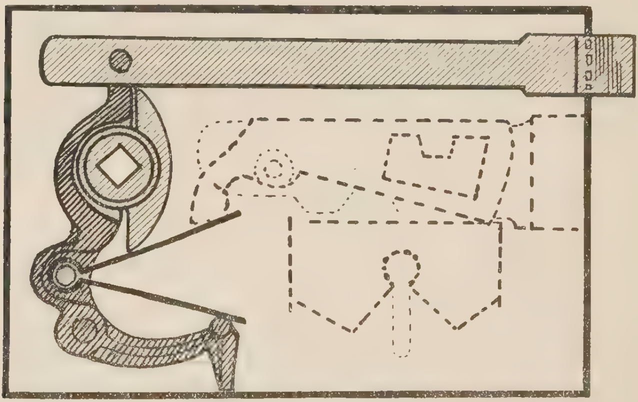

Fig. 26.—Handle Action.
(Key-lock action in dotted lines.)

circumstances the best thing to do is to take off a similar lock from another door, one that is in good working order, and an inspection of this will give you the necessary information. If you are in any doubt about it, the best thing to do is to take the lock to an ironmonger, and he will supply you with a suitable spring at a very small cost and put it in position in the lock without any charge at all.

There is generally a second spring which controls the bolt which is operated by the key, or if it is a lever lock

a separate spring is attached to each of the levers. These do not often break, but if they do, an ironmonger or locksmith will replace them for a few pence.

Sometimes you will find a lock working stiffly, and the latch not springing out properly, though the spring itself is not broken. In this case you can carefully remove all the working parts, soak them in strong soda and hot water or clean them with a little paraffin, dry them carefully, and refix them. Then apply a little machine or bicycle lubricating oil, and the lock will work properly again. If you find any part of the lock actually broken, it will probably be best to buy a new one.

The latch is operated by the spindle turning a piece of brass through which it passes.

This brass piece has a square hole for the spindle and two projecting arms which work against a right-angled projection at the far end of the latch.

The brass wears away in course of time, both where the spindle goes through it and where it works in round holes in the side plates of the lock. The ends of the brass arms also wear, and the whole affair gets too loose to work the latch properly. When this happens, a new one should be put in.

Glass Stoppers, Fixed: To Loosen.

When a glass stopper becomes firmly fixed in a bottle, the following plan is worth trying:

Stand the bottle in a saucepan of cold water, the water-level being below the top of the bottle. Gradually heat the water, either on a slow fire or on the gas stove with the gas turned rather low.

When the water begins to boil, take the bottle out and pour a little oil round the joint between the stopper and the bottle. You will find that there is generally a small groove like a trough, in which the oil will rest. If the finish of the top of the bottle does not provide for this small trough, the bottle should be rested upside down in a vessel containing oil, so that the joint between the stopper and the bottle itself is below the level of the oil.

Then allow the bottle to cool again; when it is cool the stopper will generally be found to be movable.

What actually occurs is this: In heating the bottle, the air inside tries to expand, and a little is forced out. As it cools again, the air inside contracts, and a little oil is drawn in. After standing for a short time, the oil lubricates the joint, and the stopper can be withdrawn. A slight tap with a piece of wood is sometimes necessary before the stopper can be moved.

Another method is to tie a piece of thick string to a hook, loop it round the neck of the bottle, and pull the latter to and fro quickly. The friction heats and expands the neck, and the stopper will then often come loose, if tapped gently.

Hearth Tiles, Loose: To Refix.

To refix a loose tile on a hearth, tiled floor, or any other tiled surface, it is necessary to chip away the old cement bed, so that you have a space to fill up at least $\frac{1}{4}$ inch deeper than the thickness of the tile. If the tile is $\frac{1}{2}$ inch thick, the hole should be $\frac{3}{4}$ inch deep. The bottom of this hole should be roughly finished and chipped, so that it will form a good "key" for the cement bed on which the tile rests. All the old cement should be carefully cleaned off the edges of the loose tile, and also from the tiles which border it.

The cement bed is made up of neat Portland cement and water. It must be mixed up just before it is required for use. It is better to go to a builder and ask him to oblige you by letting you have a little Portland cement. That which you buy from the general shop may be perfectly good, but even the best cement deteriorates in course of time, and what you would get might be quite worthless through this cause. If you stand on pleasant relations with a good firm of builders, they will save you this possible disappointment.

Mix up the cement so that it is about the consistency of thick cream.

Before mixing the cement, you must soak the place where the tile is to go liberally with water. Also, the tile, after you have cleaned off all loose old cement, should be left in a pail of water for some time. Some tile-layers leave the tiles soaking all night before they use them. This precaution is necessary because, if the tile or the part below the cement bed is very dry, the water in the cement will be absorbed before the cement is set.

When everything is ready, put in the cement bed, rather thicker than is necessary, and force the tile firmly into position until it is flush with the adjacent ones. This will cause the surplus cement to squeeze out round the joint between the tiles. This should be left until it begins to set, and then be cleaned off. Be careful not to loosen the tile while this is being done. Put some protecting cover over the work to prevent it being trodden on or knocked for about twenty-four hours.

Another good bedding for tiles, especially in a fireplace, is made half of plaster of Paris and half of whitening. The ingredients should be powdered finely, all hard lumps being thrown out, and very well mixed in the dry state. Mix it rather thin, and use like the Portland cement, but you must be quick about it, for this cement sets very quickly.

Knife Handles: To Refix.

If a knife handle comes loose, it can easily be pulled off. Should it resist, hold it in boiling water, which will soften the resin, and the tang can be drawn out of the handle.

Having the handle off, shake out all loose resin. Try the blade in position to make sure the knife is straight with the handle, and, if required, bend the tang to make the necessary adjustment.

Next pour melted resin into the hole in the handle, and having at the same time heated the tang, insert it and press it firmly into position, holding it there until the resin is quite set.

Leather: To Preserve.

Ink stains can be removed from brown leather by applying a solution made up of 1 part of oxalic acid to 10 parts of water. Apply this to the ink until it has been removed, and then wash off with water and dry. The leather can then be polished with brown boot polish or ordinary furniture polish. (*N.B.*—Oxalic acid is a *poison*.)

It is difficult to remove the ink without leaving that part of the leather treated with the acid somewhat lighter than its surroundings. One or two applications of brown boot polish tend to darken it again.

Boot polish or furniture polish can also be used with advantage as a preservative. Leather bags, leather book bindings, and things of this nature, can be improved in appearance and preserved at the same time.

It is also a good plan to wash leather goods occasionally and dry them, and then warm them again, and apply special leather varnish with a very soft brush.

Bookbinder's varnish should be used for black leather.

Vaseline makes a good dressing for patent-leather boots. Patent-leather shoes should be well coated with vaseline if they are to be put away for any length of time. Without this precaution it is unwise to wrap them up in paper. The paper sometimes sticks fast, and cannot be removed without damaging the surface of the leather.

Pictures: To Hang.

If there is a picture rail in a room, it is, of course, easiest to use it. Special brass hooks can be bought at any ironmonger's which fit the moulding of which the rail is made, and the picture can be moved at will until its best position is found.

When there is no picture rail, it becomes necessary to make some attachment to the wall. It is not a good plan to hammer in a brass-headed nail. There is considerable risk of spoiling the plaster with which the inside of a house

wall is finished. If the plaster begins to break away, it soon disfigures the wall. Further, a nail does not make a good hanging. The wire is bent at the point of contact into a sharp angle, and at such a place is more liable to break than any other. It is safer when the wire passes over a curved surface of larger diameter than a nail.

There is one simple form of picture-hanger which is stamped out of thin metal. This is fastened to the wall with small brass pins about $\frac{1}{2}$ inch long. They only enter the plaster, not quite reaching through to the brickwork. If these pins are carefully driven in with a hammer, the hanger is securely fastened to the wall, and is very suitable for small pictures. If, when the pins are being driven, the plaster shows a tendency to powder and crumble away, it is wise to adopt another form of hanger, in which the fastening is made to the brick face, under the plaster, such as the **X** hooks described below.

These are made in four different sizes, Nos. 1, 2, 3, and 4. They are capable of carrying the following loads: No. 1, 20 pounds; No. 2, 28 pounds; No. 3, 40 pounds; and No. 4, 70 pounds. They are attached with flat brass-headed steel pins, which are driven into the wall in a slightly downward direction. It is the angle made by the pins and the wall that accounts for the weight-carrying power of the hook. Considerable care must be taken in driving the pins in. They are long enough not only to pass through the plaster, but to enter the underlying brickwork. The pin should be held in one hand, while it is firmly tapped with the hammer. When successfully driven in, they seldom give any further trouble.

Thin copper wire about 20 gauge is far better than any of the picture cord or wire sold specially for the purpose. The wire can be easily twisted through the eyelets on the picture, and it has great tensile strength and is very durable; moreover, it does not rust, as steel wire does, in a damp atmosphere. There is a kind of picture wire consisting of a very fine iron wire, much finer than piano wire, indeed, little thicker than a hair, wound round with silvery-looking wire like the thicker strings of a banjo. It is not

at all dependable, and should be avoided, though it looks pretty, and the surrounding coiled wire makes it look substantial.

Plugging a Wall.

For a very heavy picture the wall should be plugged. Into this a strong brass-headed nail can be driven; if you fix a small brass pulley wheel under the head, it avoids the sharp angle in the wire, and also makes it much easier to adjust the picture. It is better to hang a heavy picture or other hanging article by two wires or chains. Plugging is also necessary for some of the larger hanging bookshelves, large mirrors and brackets which are intended for carrying some heavy object.

For plugging a wall you require a special tool. It is very like a drill, such as is used for drilling holes in metal. It is made of steel, and is usually about 9 or 10 inches long. The point is finished just like a drill, and the other end is square for hammering. The hammering end is about $\frac{3}{4}$ inch square in section. Through this, about 1 inch from the end, a hole is made, at right angles to the axis of the tool, large enough to allow a piece of round steel about 4 inches long and $\frac{1}{4}$ inch in diameter to pass through. This piece of steel acts as a handle for twisting. You first hammer in the pointed end until you feel you are through the soft plaster and have reached the hard brick, when you can twist the tool round until it moves easily. Then hammer it in gradually, keeping it twisting all the time. It is well to withdraw the tool occasionally and scrape out the loose brick-dust and fragments; then put in the drill and hammer away until you have a round hole about 3 inches deep. Into this hole you drive your wooden plug. This should be made of soft pine, and should be 3 inches long, and tapering from end to end. The small end should be the same size as the hole, and the larger end about $\frac{1}{4}$ inch larger. The small end, of course, goes in first. When this is firmly driven home, so that it finishes flush with the wall, it forms a compressed wooden fixing, into which a strong nail can be driven that will support any usual load

required. If it is found that the wooden plug cannot be driven right home, the projecting end can be cut off with a chisel without damaging the wall.

A newer method of plugging walls is known as the Rawlplug. It is an excellent means of fixing screws into a wall of almost any material.

A sample outfit can be bought for 5s. 6d. It consists of 100 assorted plugs, with screws, and the special tools that are necessary. The special feature of the patent is the tubular plug of stiffened fibre, which exactly fits the hole made by the tool. When a screw is turned into this tube, it expands the fibre, and makes a very secure fixing to the wall. One of its great advantages is that it does very little damage to the wall, but without practice it is not easy to locate the plug precisely where you want it.

It should be realized that ordinary screws, and, in consequence, Rawlplug tools and plugs, are graded according to diameter. "No. 8," the size of the above-mentioned sample outfit, is perhaps the most generally useful household size; but, of course, No. 8 or any other grade of screws and plugs may be purchased in various *lengths*, according to the depth of the hole required. The next largest Rawlplug size, No. 10, is frequently useful for heavier work, such as hanging bookshelves.

Success in plugging, *where only the plaster is penetrated*, varies according to the quality of the plaster. It is always better to drill through the plaster and get the Rawlplugs into the brick. But in good hard plaster they will hold surprisingly well, as they do in tiled walls. It is not fair to expect miracles of them, however, when you set them, for instance, in a *loose* plaster wall founded on laths.

In such a wall you can only get a firm hold by finding the uprights to which the laths that carry the plaster are nailed. This *may* be done by probing the plaster with a fine bradawl, till you are certain you are piercing the solid upright and not a lath, but this experimental method leaves a row of holes in the plaster. Sometimes you may be able to prise away the wainscoting at the foot of the wall, when the ends of the uprights may be seen; they are

generally 15 inches apart, from centre to centre of the uprights, which are usually 2 inches wide. From such data, by the use of careful measurement, a plumb-line, *and* common sense, you should be able to hit your solid upright through the plaster at the first shot. The uprights being wooden, Rawlplugs are, of course, unnecessary.

Rawlplugs are frequently useful in minor household repairs, as when the screw-handle of a drawer or cupboard door draws out, and will not screw in again because the hole has worn and become too large. The old plan was to make a fresh hole near by; but a Rawlplug inserted in the hole will give the old screw a good grip.

Soldering.

Soldering is not usually regarded as one of those simple operations that can be undertaken by an amateur with little or no experience. It is true that some soldering jobs are difficult and require special training and skill. What is known as a " wiped," or " plumber's," joint, such as is required for joining two pieces of lead pipe together, should certainly be left for a skilled plumber. But there are certain of the smaller repairs which can be easily accomplished, if the few instructions given here are carefully followed.

There is only one special tool required. It is called a soldering iron, or " copper bit." It consists of a copper head secured to an iron rod with a wooden handle. The head, which is the most important part, is made in various forms. For ordinary household repairs a straight head, terminating in a point, is the most serviceable. They are generally sold by the weight of the head. One weighing about 1 pound is best for the purpose.

The other materials required are solder and " killed " spirit.

Solder is a combination of tin and lead. The reason the tin is included is because it has a lower melting-point than any of the common metals. Solder is sold by weight, and is made in various shapes. The ordinary " Tinman's "

"stick" solder is the best for our purpose. It is more or less round in section, and rather thicker than a lead pencil.

The "killed" spirit is hydrochloric acid, commonly called "spirits of salt" (see p. 37), treated by dissolving in it small pieces of sheet zinc. This one must do at home. You put the acid into a jar and add the small pieces of zinc little by little. Directly the zinc is put in it starts a rather violent chemical action, and on this account it is advisable to do it out of doors, and be careful to keep your head away from the fumes, which are most unpleasant. When the first agitation has subsided, add more zinc, and continue the process until the acid ceases to boil, when it is said to be "killed," and is ready for use. It can then be poured into a bottle and corked up securely. It is a *poison*, and should therefore be put in a special bottle made for the purpose. The spirit will keep for a very long time.

Perhaps the most common repair in a house for which soldering is useful is the stopping of a leak in a kettle or a saucepan or a galvanized-iron bath. It may also be the copper ball of a ball-valve.

The first thing to do is to find the spot where the leak is. Having found it, the really most important part of the work has to be done. This is the cleaning of the place where the solder is to be applied. And in this case we must not be satisfied with what is apparently clean; *it must also be what is called chemically clean.*

All the soot and dirt must first be rubbed off with emery cloth. You will probably find that with this you cannot get at every part where the dirt can be seen, and every speck must be cleaned away, leaving clean bright metal, for solder will stick to nothing else. You may require the thin end of a file or even a pen-knife or a hat-pin. The important thing is that all dirt must be removed, and the surface to be covered with solder left shining bright. Having done this, you have next to prevent the process of oxidizing from starting. Long before you can perceive it with your eye, the process will have started and rust will be forming. To prevent this we must apply "killed" spirit or other "flux."

Pour a little spirit out into a small dish, and apply it with a small stiff brush. An old toothbrush is as convenient as anything. Do not get the spirit on your hands; it makes them rough and sore. But satisfy yourself that all the brightened surface has been washed with the flux. This effectively stops oxidization.

Next arrange the work with the part to be repaired on top and level, if possible. Prop it up steadily in position so that you do not have to hold it. Heat the iron by putting it *in a bright part* of a coal fire. It can be heated by gas, but gas is likely to make the iron dirty. Therefore it is better to use a coal fire if one is available. If not, you can use gas and clean the point of the iron by rubbing it on a lump of sal-ammoniac. This quickly cleans off the dirt.

Be very careful not to overheat the iron. It should be carefully watched and taken out when it begins to show a green flame. If you allow it to become too hot, the tinned surface on the point will be burnt off, and the iron must then be retinned. To do this you must heat the iron: just plunge it in the spirit jar for a moment, or rub it on the sal-ammoniac, and rub the point with solder until all the tapering surfaces shine brightly again.

When the iron is hot, touch the part to be repaired with spirit, take up the solder in one hand and the iron in the other. Just dip the iron in the spirit for a moment and apply it to the solder. A little of this will immediately fuse and drip down, so you must hold the solder directly over the patch to be repaired. Run the solder over the patch with the point of the iron. You will find you can easily direct it with the soldering iron, and that it will spread evenly over the prepared surface. When this is done your job is complete, and the acid must be washed off with water.

If you are repairing a large hole in any vessel, you must adopt a different plan. The cleaning process must be just as scrupulously carried out as before, and the surface protected with the spirit. You must then cut a patch of tinned iron large enough to cover the hole completely,

A piece of a tobacco tin or any *clean* tin box will do. The first thing to do is to rub the surface round the hole with spirit, and form a ring of solder round it. Then rub the patch with spirit and cover it with a coating of solder. Then put the patch with the tinned side downwards on the ring of solder, and hold the hot soldering iron on it until the solder remelts and the patch sticks firmly.

If you have to repair a leaky ball-valve (see p. 21), first drain the water out by enlarging the hole; you must then treat the copper in exactly the same manner as repairing iron. It must be scrupulously cleaned, scrubbed over with "killed" spirit, and tinned, as described in the case of a leak in a kettle or saucepan.

After a very little practice you will find you can do these small jobs neatly and successfully.

Killed spirit must *not* be used in electrical work, as it is acid, and corrodes the metal when electric current is passing. For fluxes to be used in such work see footnote to page 107.

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